Spotter Training 2015

Tama / Jasper County
July 6, 2014

Rockwell City June 30, 2014

Clarke County May 11, 2014

All Photos Courtesy
KCCI uLocal Page

Outline

- Introduction
- Being a Storm Spotter
  - Sending Reports, What to Report & Staying Informed
- Spotter Safety
- 2014 Iowa Weather Review
- Iowa Severe Weather Climatology
- Thunderstorm Fundamentals
- Types of Storms and Features
- Tornadoes
  - Lifecycle, Types & Falsenadoes

Source Unknown

Courtesy CBS News

The National Weather Service

Who we Are…

Federal government weather forecast agency

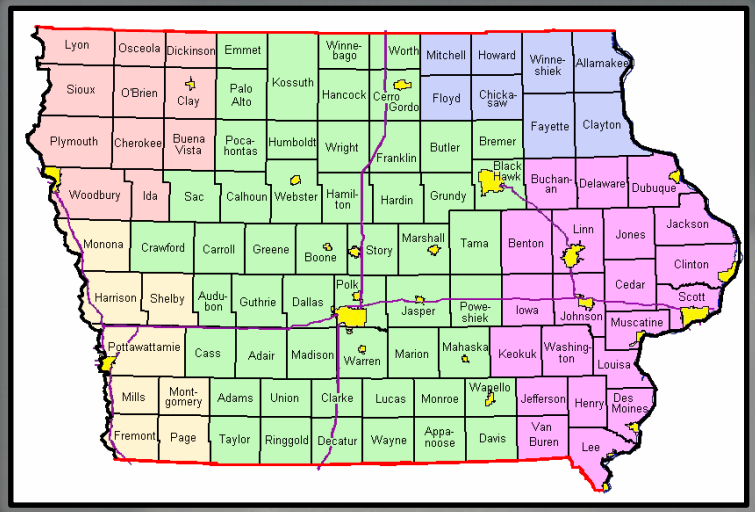
Who we Serve…

- United States & Territories
- Five Offices Serve Iowa

Primary Mission…

Provide weather warnings for the protection of life and property

As a spotter, you help us accomplish this mission!

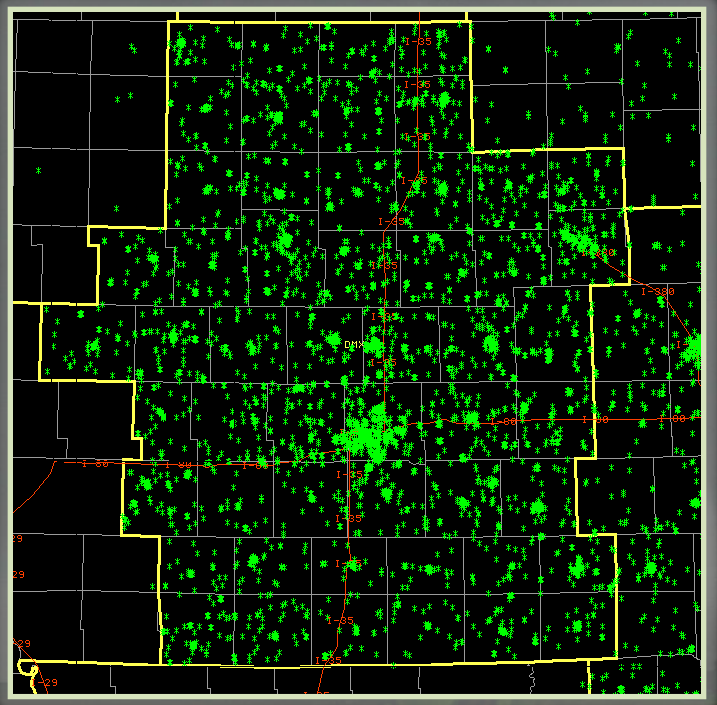


The Role of the Spotter

- Your reports are used in real-time to help meteorologists issue warnings
- Radar has many limitations; your reports provide vital ground truth
- Spotter reports are immediately released to the world to increase the response to the threat

We need **your** help to save lives and protect property!

The NWS Spotter Network



- Over 4,300 spotters and counting
- Contact the NWS directly with severe weather reports
- Spotters especially needed in rural areas

Interested in joining?
Register here or online!

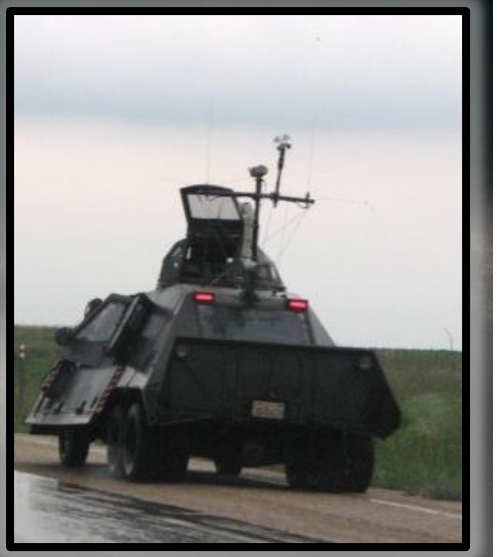
Other Types of Spotters

Local Fire/Police

Often report severe weather to dispatch, who then relays the report to the NWS.

Amateur Radio

Can be part of a net or independent.
Call sign for NWS Des Moines is **KØDMX**.



Storm Chasers

Cover large areas and chase for a hobby. Can send out video/photos in real-time online.

How to Report to the NWS

- **1-800-SKYWARN**
  Available for *ALL* spotters, dispatch centers and EOCs
- **Amateur Radio (KØDMX)**
  Amateur radio operators only
- **Social Media**
  Facebook and Twitter
- **Text Messaging**
- **E-mail**
- **Online Reporting Form**

Courtesy Extreme Instability

Courtesy Extreme Instability

Social Media

How to Report to the NWS

Twitter (@NWSDesMoines)

- Send reports directly to us
- Add #nwsdmx or #iawx to your tweets

Facebook (NWS Des Moines)

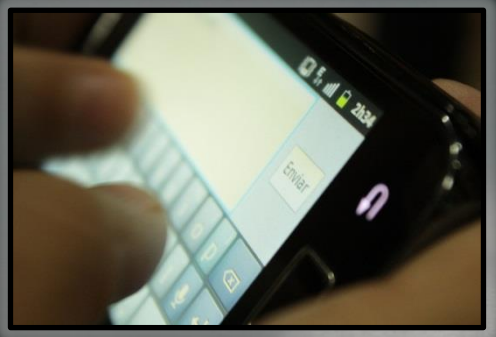
- Post reports, photos & videos directly on our page
- Be sure to include your location and time

We encourage <u>everyone</u> to like and follow the NWS on Facebook and Twitter!

Text Messaging and Email

How to Report to the NWS

- **Text Messaging**
  (515) 240-5515



- **E-mail**
  dmx.spotterreport@noaa.gov
  Great for pictures and video

Remember!

Include the **time**, **date**, and **location** of severe weather with your report

Online Reporting Form

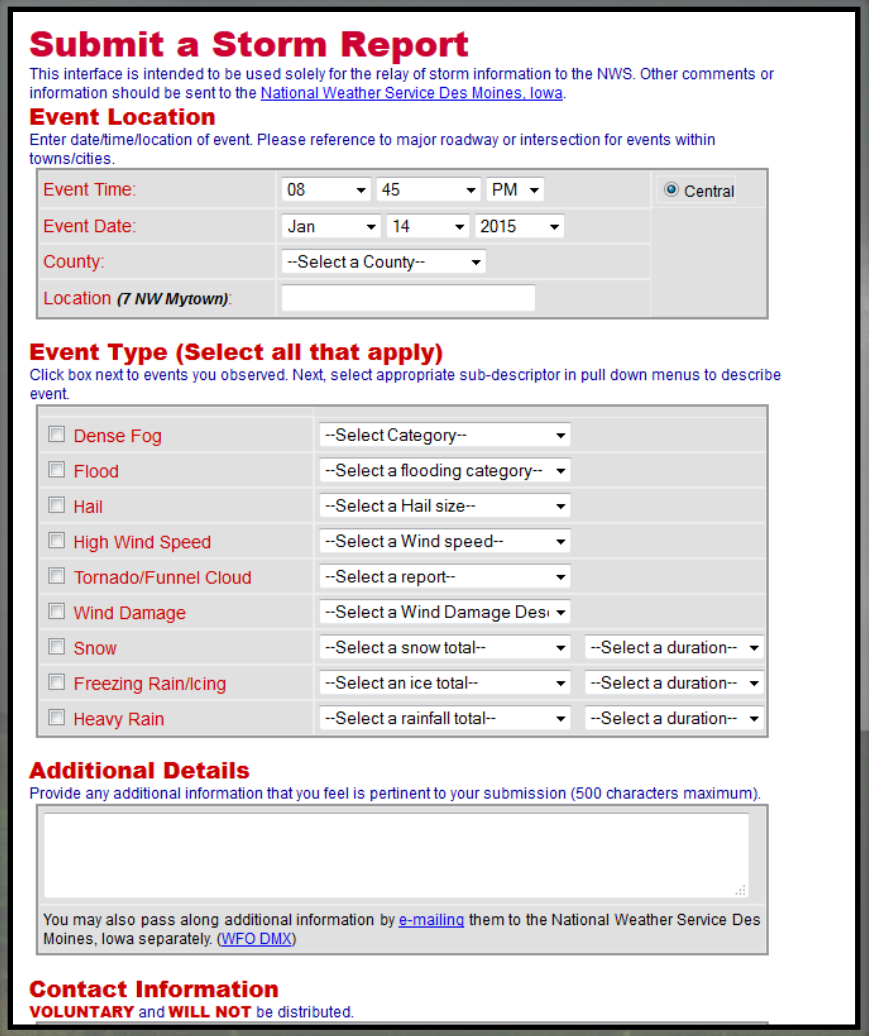
How to Report to the NWS

This form is available on our website at:

weather.gov/desmoines

Click "Submit Report" on the left hand column and then select the online form link

The form will guide you on what information to report



Submit a Storm Report

This interface is intended to be used solely for the relay of storm information to the NWS. Other comments or information should be sent to the National Weather Service Des Moines, Iowa.

Event Location

Enter date/time/location of event. Please reference to major roadway or intersection for events within towns/cities.

Event Time:	08 45 PM	Central
Event Date:	Jan 14 2015	
County:	--Select a County--	
Location *(7 NW Mytown)*:		

Event Type (Select all that apply)

Click box next to events you observed. Next, select appropriate sub-descriptor in pull down menus to describe event.

Dense Fog	--Select Category--	
Flood	--Select a flooding category--	
Hail	--Select a Hail size--	
High Wind Speed	--Select a Wind speed--	
Tornado/Funnel Cloud	--Select a report--	
Wind Damage	--Select a Wind Damage Des	
Snow	--Select a snow total--	--Select a duration--
Freezing Rain/Icing	--Select an ice total--	--Select a duration--
Heavy Rain	--Select a rainfall total--	--Select a duration--

Additional Details

Provide any additional information that you feel is pertinent to your submission (500 characters maximum).

You may also pass along additional information by e-mailing them to the National Weather Service Des Moines, Iowa separately. (WFO DMX)

Contact Information

VOLUNTARY and **WILL NOT** be distributed.

What to Report

Who?	Spotter number/source
What?	What are you seeing? Use proper terms
Where?	Reference the nearest city, street, or lat./lon.
When?	Time of event (if in the past)
Damage?	Be descriptive

Be as specific as possible!

Include all of the above information in your reports regardless of the reporting method

Tornadoes

What to Report

- **Rotating Wall Clouds**
- **Funnel Clouds**
  - How far down to the ground?
- **Tornadoes**
  - Do you see any dust or debris below the funnel?
  - How far away is tornado? (estimate the distance and direction)
  - Speed & motion of the tornado?
  - Size of the tornado? Is it changing? (getting larger, roping out, etc.)
  - Any damage, injuries, or deaths?

Hail

What to Report

Report all hail, regardless of size

- Measure the **diameter** of the hailstone
- If you can't measure the hail, compare to common coin or ball sizes
  - **Do not report marble-sized hail!**
- Report the size of the largest hailstone you measure (and the average size if possible)

Courtesy Jessica Varno

What Size are Your Marbles?

Diameter	Description
1/4"	Pea
1/2"	Dime
3/4"	Penny
1"	Quarter
1.25"	Half Dollar
1.50"	Ping Pong

Diameter	Description
1.75"	Golf Ball
2"	Hen Egg
2.50"	Tennis Ball
2.75"	Baseball
3"	Tea Cup
4"	Grapefruit

Damaging Winds

What to Report

- Wind Strength
  - Measured or estimate
- Tree damage
  - Size of tree limbs snapped off
  - Trees trunks snapped or uprooted?
  - Was the tree old or rotten?
- Building damage
  - Due to wind or trees falling onto the building?
- How long did the winds last?
- What direction was the debris blown?
  - Debris all blown in the same direction?

Photos Courtesy
KCCI uLocal

Flash Flooding

What to Report

- What is being impacted?
  - Roads, houses, farm fields, etc.
- Water Depth? (estimate)
- Is the water standing still or flowing?
  - If flowing, how fast?
- How often does this location flood?
- How much rain has fallen at your place during the storm?
  - How quickly did the rain fall?


Courtesy IADOT


Courtesy Ted Welch


Courtesy Wapello County EMA

What to Report

Communication is Vital !

- Do you know how your report will reach the NWS in real-time?
- Your report can make a significant difference and it may save lives

Warning!

Do not report output from radar sources or warning text as a fact

Ex: Radar or a warning suggests there is golf ball size hail with a storm. Do not report this hail size unless it is actually observed.

What to Report

Can't remember all of this?

Don't Worry!

Reporting Severe Weather

Reporting severe weather is essential! Remember that each report, regardless of the method, must include the time and location of the event. Pictures tell a thousand words, but not when and where the weather occurred!

How to Report:

Online: Use our online weather reporting form! *For reporting tornadoes, please use our 1-800-SKYWARN telephone line.*

Email: dmx.spotterreport@noaa.gov - A great way to include pictures and/or video.

SMS Text Messaging: (515) 240-5515 - Send your phone pictures and text messages to this number with time, date, and location information. With pictures, include a bit of text describing the direction you are looking.

Telephone: 1 (800) SKYWARN - Must have been through severe weather spotter training and belong to a spotter network to use this line! Refer to materials received during spotter training.

Facebook: Visit our Facebook page and post a severe weather report to our wall.

Twitter - Send Twitter reports to the National Weather Service by including the #iawx hashtag.

Amateur Radio – The National Weather Service group amateur radio call-sign is *KØDMX*.

All of this information is on our handout or at weather.gov/desmoines on the **Submit Report** webpage

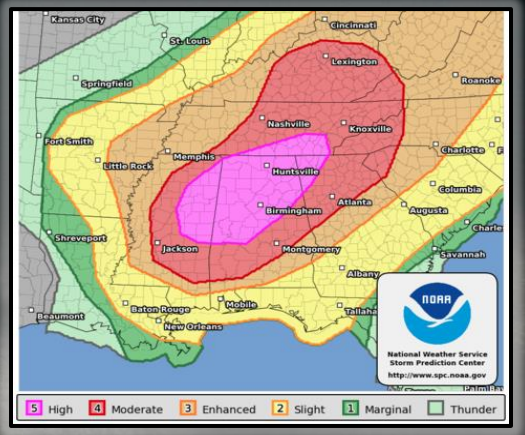
Days Ahead of the Event

Staying Informed

Severe Weather Outlooks

www.spc.noaa.gov

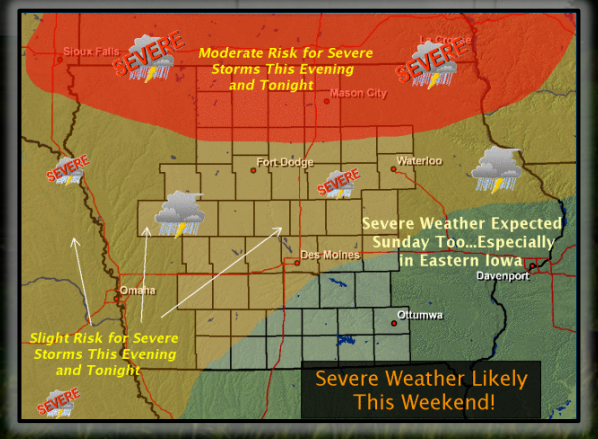
National outlooks for the upcoming three days



Risk for Severe Weather

None | Gen Storms | Marginal | Slight | Enhanced | Moderate | High

Replaces "See Text" — New for 2015



Weather Story

www.weather.gov/desmoines

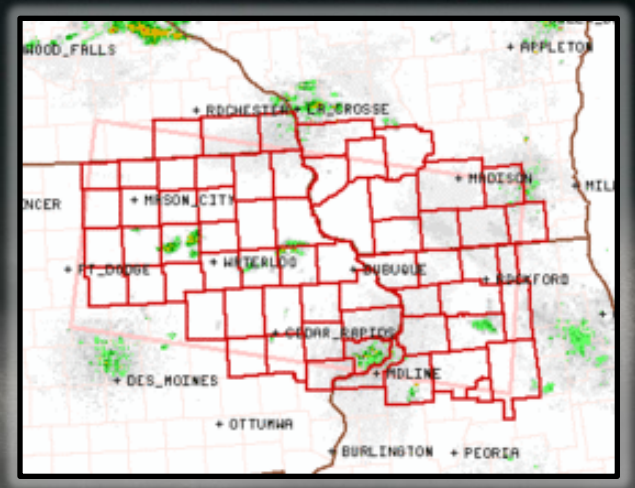
Highlights the most significant weather expected in the next few days in central Iowa

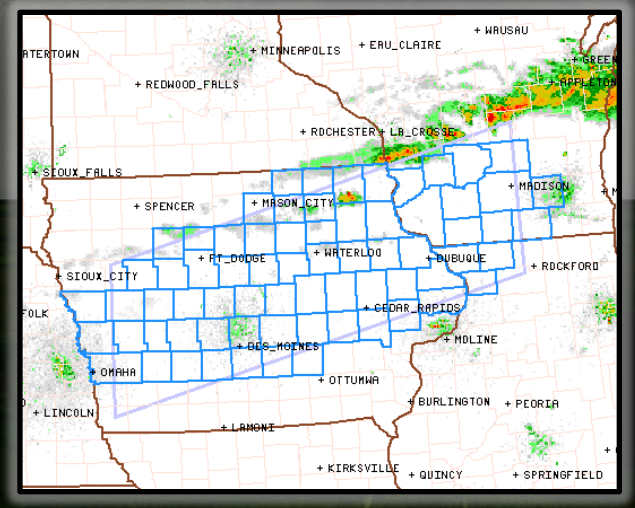
Severe Weather Watches

Staying Informed

Watch the Skies

- Issued when ***conditions are favorable*** for the development of severe weather
- In effect for 4 to 6 hours and cover large areas of the state





Types of Watches:

Tornado Watch

Severe Thunderstorm Watch

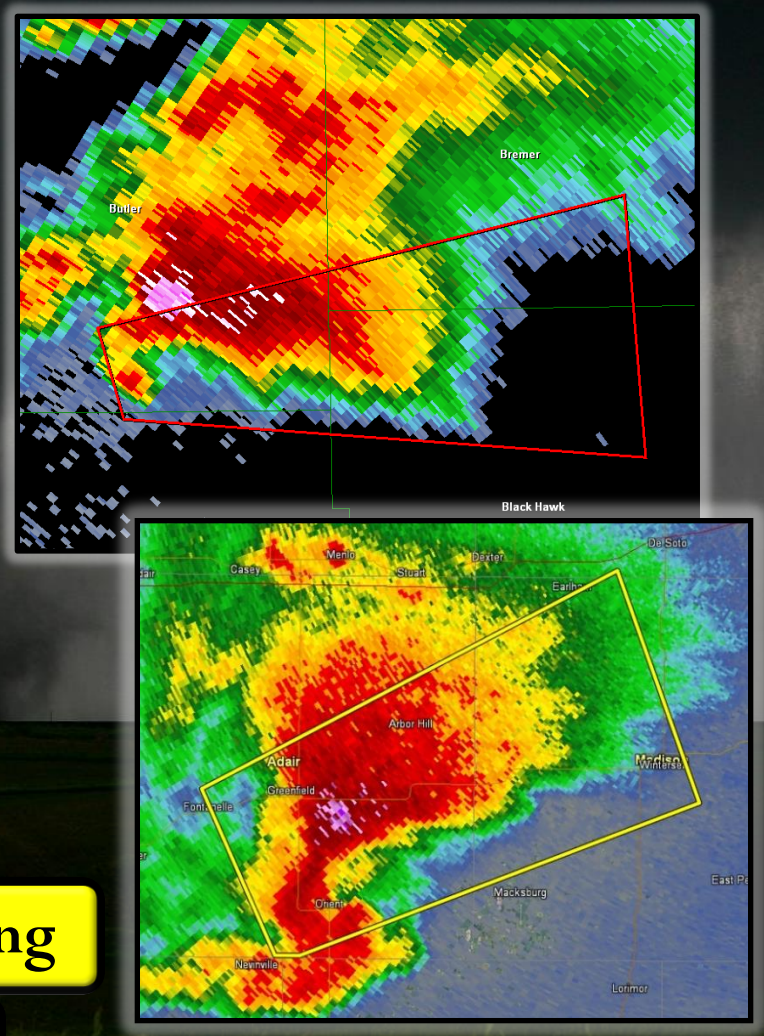
Flash Flood Watch

Severe Weather Warnings

Staying Informed

Take Action Now!

- Means severe weather is occurring or expect to occur very shortly
- Seek shelter now!
- The warning polygon is issued for the specific storm or threat



Types of Warnings:

Tornado Warning

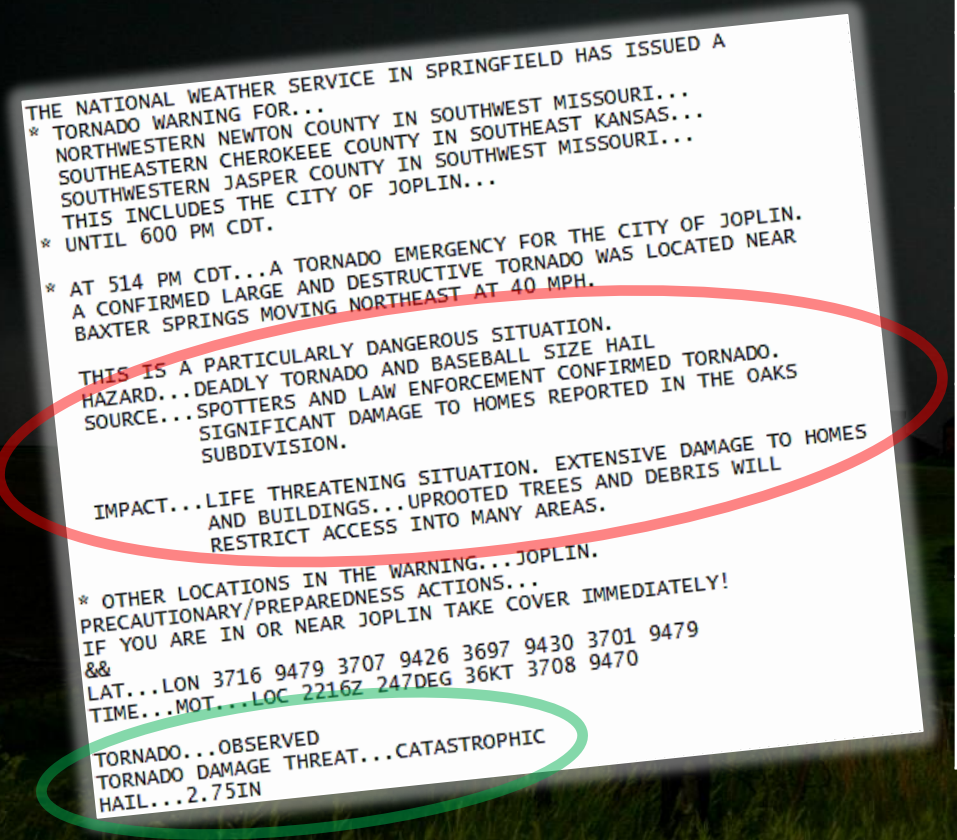
Severe Thunderstorm Warning

Flash Flood Warning

Severe Weather Warning Text

Staying Informed

Warning text describes impacts and uses "tags" to make important information easier to find



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THE NATIONAL WEATHER SERVICE IN SPRINGFIELD HAS ISSUED A
* TORNADO WARNING FOR...
  NORTHWESTERN NEWTON COUNTY IN SOUTHWEST MISSOURI...
  SOUTHEASTERN CHEROKEEE COUNTY IN SOUTHEAST KANSAS...
  SOUTHWESTERN JASPER COUNTY IN SOUTHWEST MISSOURI...
  THIS INCLUDES THE CITY OF JOPLIN...
* UNTIL 600 PM CDT.

* AT 514 PM CDT...A TORNADO EMERGENCY FOR THE CITY OF JOPLIN.
  A CONFIRMED LARGE AND DESTRUCTIVE TORNADO WAS LOCATED NEAR
  BAXTER SPRINGS MOVING NORTHEAST AT 40 MPH.

  THIS IS A PARTICULARLY DANGEROUS SITUATION.
  HAZARD...DEADLY TORNADO AND BASEBALL SIZE HAIL
  SOURCE...SPOTTERS AND LAW ENFORCEMENT CONFIRMED TORNADO.
          SIGNIFICANT DAMAGE TO HOMES REPORTED IN THE OAKS
          SUBDIVISION.

  IMPACT...LIFE THREATENING SITUATION. EXTENSIVE DAMAGE TO HOMES
           AND BUILDINGS...UPROOTED TREES AND DEBRIS WILL
           RESTRICT ACCESS INTO MANY AREAS.

* OTHER LOCATIONS IN THE WARNING...JOPLIN.
PRECAUTIONARY/PREPAREDNESS ACTIONS...
IF YOU ARE IN OR NEAR JOPLIN TAKE COVER IMMEDIATELY!
&&
LAT...LON 3716 9479 3707 9426 3697 9430 3701 9479
TIME...MOT...LOC 2216Z 247DEG 36KT 3708 9470

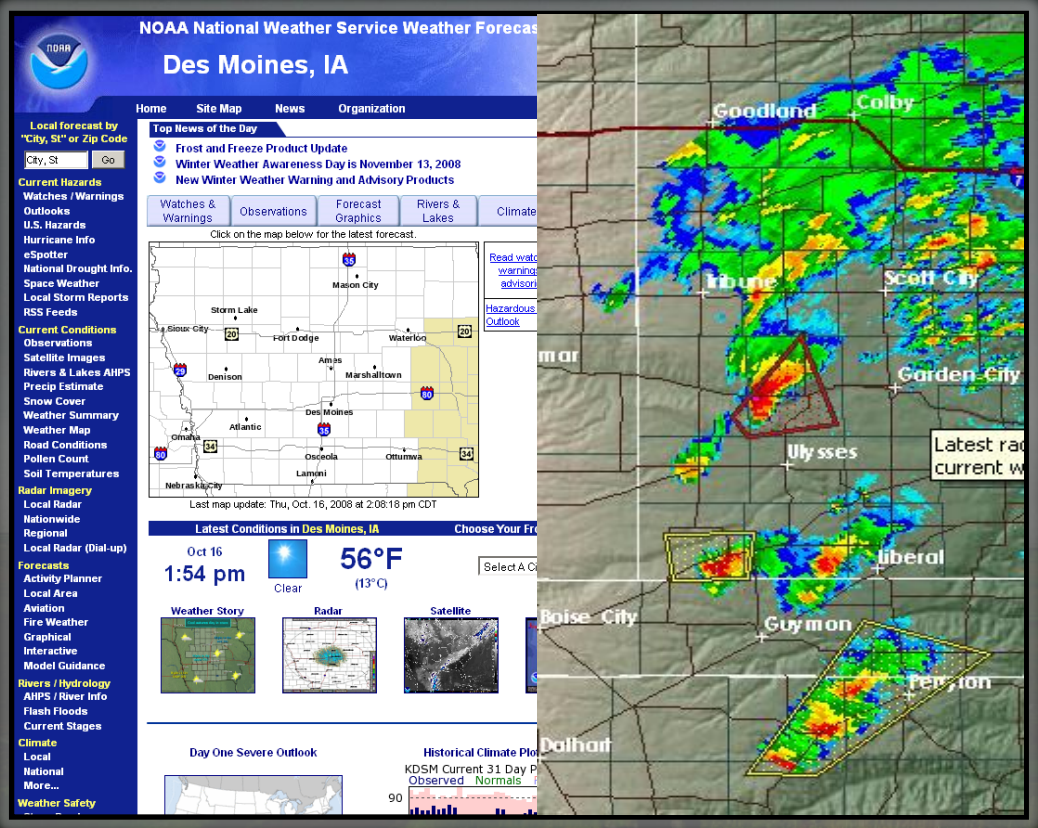
TORNADO...OBSERVED
TORNADO DAMAGE THREAT...CATASTROPHIC
HAIL...2.75IN
```

Tornado Warning Tag	
TORNADO...RADAR INDICATED	Evidence on radar is supportive of a tornado, but there is no ground confirmation.
TORNADO...OBSERVED	Tornado is confirmed by spotters, law enforcement, etc.
Tornado Warning Damage Threat Tag	
No Tag	Used most of the time when tornado damage is possible.
TORNADO DAMAGE THREAT...CONSIDERABLE	Used rarely when there is credible evidence that a tornado is capable of producing considerable damage.
TORNADO DAMAGE THREAT...CATASTROPHIC	Used exceedingly rarely when a severe threat to human life and catastrophic damage from a tornado is occurring.
Tornado Tag In Severe Thunderstorm Warnings	
TORNADO...POSSIBLE	A severe thunderstorm has some potential to produce a tornado

National Weather Service Website

Staying Informed

www.weather.gov/desmoines



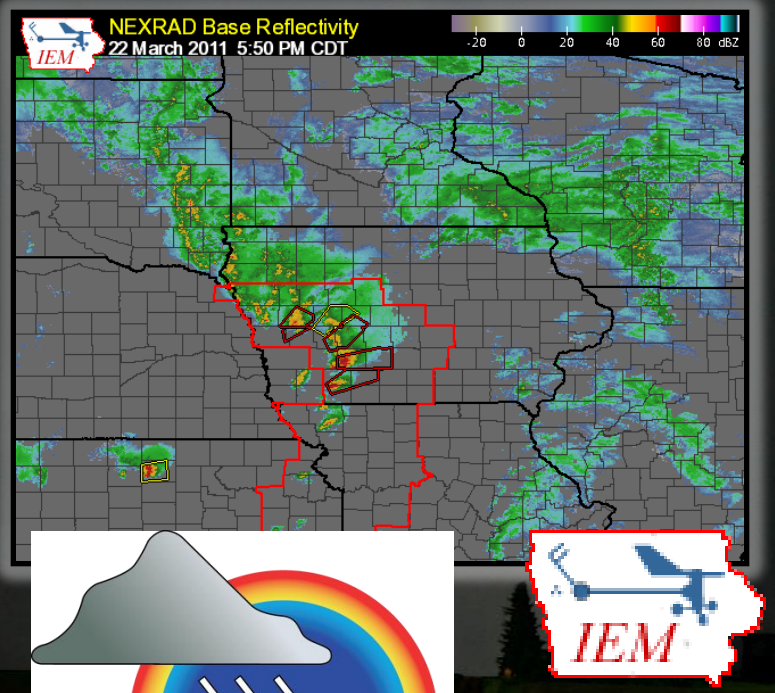
"One Stop Shop"

- Access to all outlooks, watches, and warnings
- Submit spotter reports
- Can view radar data with warning polygons
- Seven day forecast

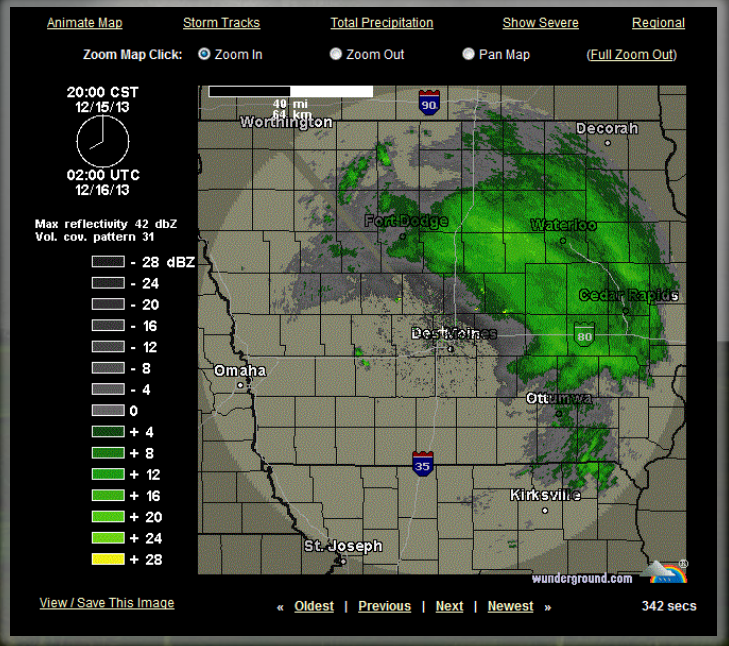
…and much more

Third Party Websites

Staying Informed



Dozens of third party sites that display warning and radar information



wunderground.com

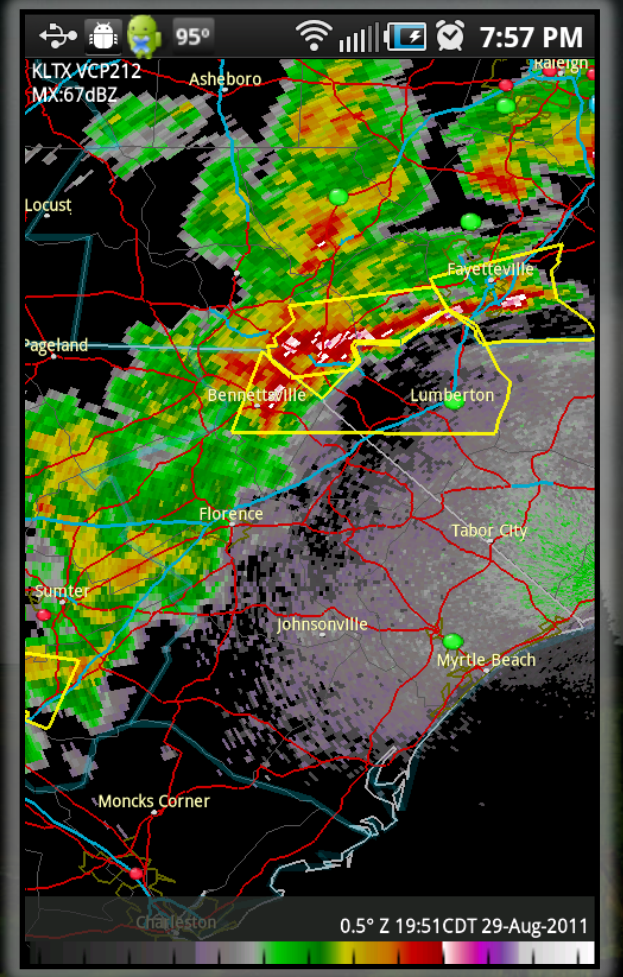
IEM

AccuWeather.com

The Weather Channel

Smartphone Apps

Staying Informed

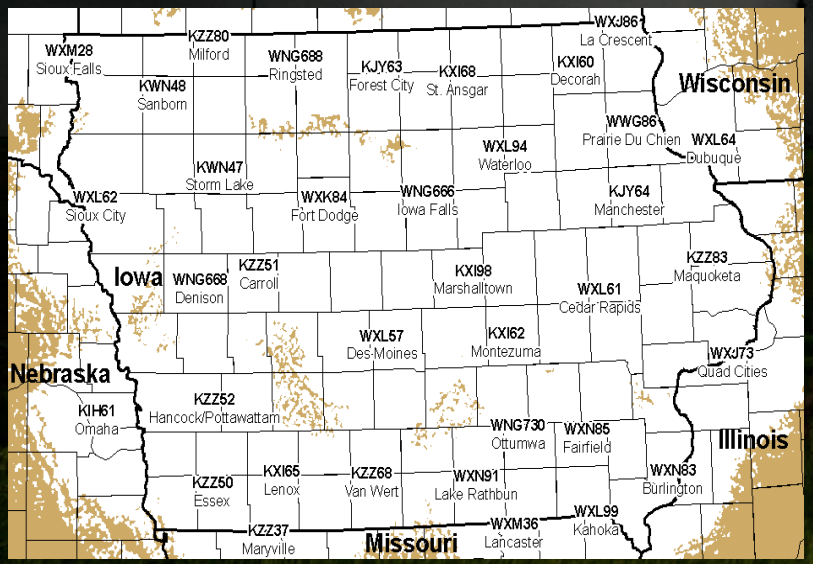


- Many apps available that provide current conditions, weather forecasts, radar data, and warnings for your location
- **Wireless Emergency Alerts (WEA)**
  - Tornado and flash flood warnings
  - Coming soon: High-end severe thunderstorm warnings
- Several powerful radar apps:
  - RadarScope – iPhone and Android
  - PYKL3 – Android only

NOAA Weather Radio

Staying Informed

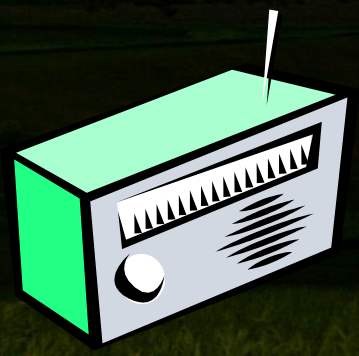
- Operated by the NWS and broadcasts weather forecasts and warnings 24/7
- Coverage over most of Iowa
- Need a special radio receiver
- Can program the radio to only alert for certain counties



Television and Radio

Staying Informed

- Radio stations will interrupt their programming to broadcast watches and warnings
- TV stations usually place a crawl at the bottom of the screen with the watch/warning information
  - Often will interrupt programming if the storm is heading towards a highly populated area



Additional Resources

- Online Spotter Resource Page
  See handout- online courses and excellent printable spotter guides
- Advanced Spotter Training
  Ready for the next step? Advanced spotter training is at 7:00pm on April 23 in Cedar Falls. UNI Latham Hall – Room 125.
- Spotter Webinars
  Regular & advanced classes offered online. See our website for details.

Training Resources

The National Weather Service (NWS) and emergency managers host spotter training classes across central Iowa each spring. Training is delivered by a combination of "in-person" spotter training classes scattered across central Iowa and webinar-based distance learning classes. In-person spotter training classes are offered in larger cities and towns and in several rural counties and small towns. Every county in the NWS, Des Moines, County Warning Area (CWA) has a "in-person" spotter training class at least every other year. To supplement "in-person" training, the NWS conducts weekly webinars using Join-Me internet-based distance learning webinars during spotter trainnig season. All webinars are open to all spotters! One "advanced" spotter class is also offeredl. The advanced class will build on what is taught in the regular class. It is intended for those who wish to do mobile spotting and desire a deeper understanding of meso-scale and storm scale meteorology as it relates to storm spotting.

In addition to live National Weather Service spotter training presentations, there are several on-line training opportunities available.

On-line spotter training resources

- Spotter Data Quality Training
- Spotter Reference Cards - *Download PDF spotter reference cards to use while spotting!*
- 2013 Course Notes and Registration Info - *Will be updated by March 1, 2013*
- Spotter's Field Guide - *large PDF which may take a while to download (Updated for 2012)*
- Wind and Hail Reference Table
- Spotter Do's and Don'ts
- **National Weather Service, Des Moines, Spotter Training DVD** - *The DVD is available for emergency managers, fire departments and amateur radio clubs within the WFO Des Moines County Warning Area. It is ideal for groups who cannot attend a regular spotter training class, but still need training. To request a Spotter Training DVD, please e-mail Jeff Johnson at jeff.johnson@noaa.gov. Please include your name, agency/department/group and your address.* ***The Spotter Training DVD is NOT available for individual spotters or the general public.***
- On-line SKYWARN Spotter Training - **NEW as of September, 2011**- This course was developed by COMET which is a program that supports, enhances and stimulates learning about atmospheric and related sciences. It was not developed by the National Weather Service office in Des Moines. The on-line course does **NOT** replace the need to attend a National Weather Service spotter training class.

Spotter Safety

Tornadoes

Lightning

Strong Winds

Hail

Flash Flooding

Tornadoes

Spotter Safety

Courtesy Severe Studios, Inc

- **Maintain situational awareness at <u>ALL</u> times**
  - Avoid "tunnel vision"
- **<u>ALWAYS</u>** have an escape route
- Seek a sturdy structure if you are in danger
- Avoid night spotting
  - Hard to see anything
  - Very dangerous!
- If your car is struck by even a weak tornado, your life is in danger!

Tornadoes – Vehicle Safety

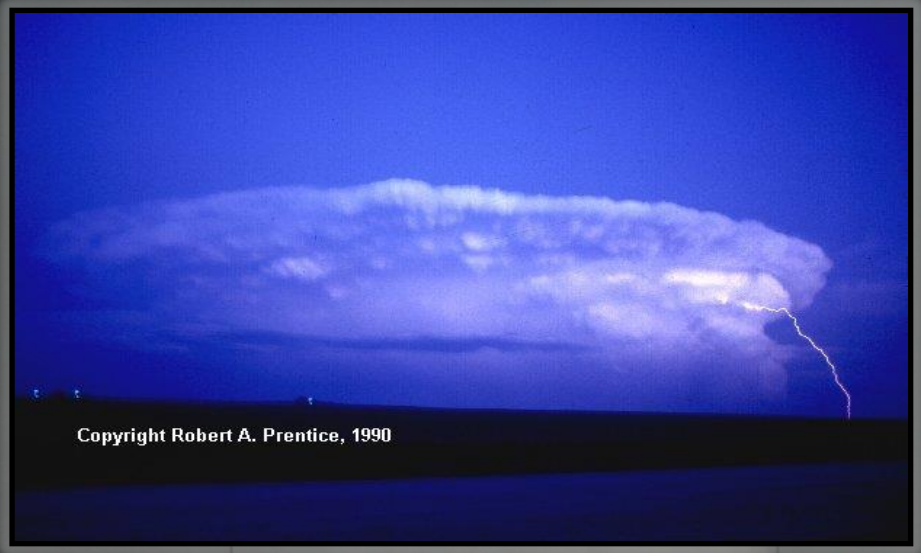
Spotter Safety

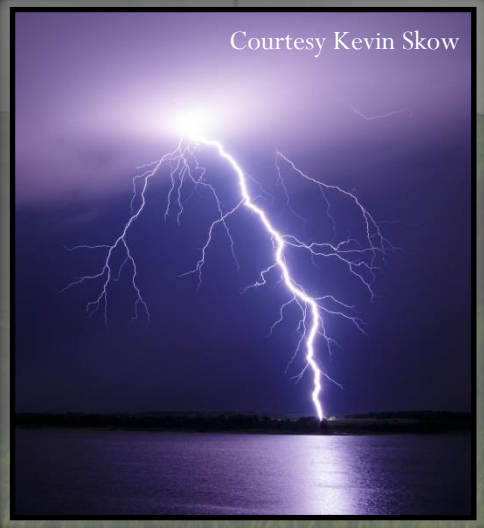
Cars, trucks & SUVS are NOT safe!

Underpasses are NOT safe!

Lightning

Spotter Safety





- Lightning is by far the most common hazard facing spotters
- Be careful on ridge tops and open areas
- Stay in vehicle if mobile

Hear thunder?
You are at risk!

Strong Winds

Spotter Safety

- Frequent with squall lines, but can occur with any type of storm
- Often on the leading edge of a storm
  - However, can travel far from the actual storm
- **Do not** seek shelter under trees or in small structures that might collapse!

Hail

Spotter Safety

- Hail can fall at speeds of over **100 mph**!
- Even small hail can cause damage and injury
- Take shelter in a walled structure and stay away from windows
- Wind-driven hail is very dangerous and destructive

Flash Flooding

Spotter Safety

- The #1 severe weather-related killer in the US!
- Heavy rainfall combined with saturated soils
- Impacts amplified by terrain or poor drainage (e.g. cities)

Remember:
Turn around, don't drown!

Spotter Safety

Your SAFETY is our #1 concern!

Courtesy Tim Wagner and Mark Schnackenberg

- Keep an eye to the sky
- Prepare for all hazards
- Watch for flooding & lightning
- Drive smart & safely
- **Use common sense**

Remember, the National Weather Service does not "officially" deploy spotters. Spotting is done at one's own risk!

Iowa 2014 Severe Weather

- A rebound in tornadic activity – 55 confirmed tornadoes
  - More than 2012 and 2013 combined
- Numerous damaging wind and hail events
  - Late spring and early/late summer
- A wet year with periods of flooding into September

Tree damage near Mason City – June 16

Flooding near Norwalk – September 11

Iowa 2014 Tornadoes

- 55 tornadoes, 0 injuries, 2 deaths
- June 16 the most active day with 12 tornadoes
  - Other major events on May 11 (8), June 30 (8), and July 6 (9)
- June the most active month with 31 tornadoes
  - July the second most active month with 9

Tama County – July 6

Guthrie & Dallas Counties - May 11

Iowa 2014 Wind & Hail

A few of Iowa's significant events:

April 12: Widespread ping pong to tennis ball size hail across Iowa

Photo: Waverly, IA

June 3: Golf ball to baseball size hail driven by 80 mph winds causes major home and crop damage in SW Iowa

June 30: Multiple waves of severe weather; 4 inch hail near Rockwell City (left photo) & wind-driven hail in western IA

Iowa 2014 Floods

- Average to above average rainfall over the state
- River flooding in early summer in northern and eastern Iowa
- Periods of flash flooding statewide in mid to late June and again in the early fall

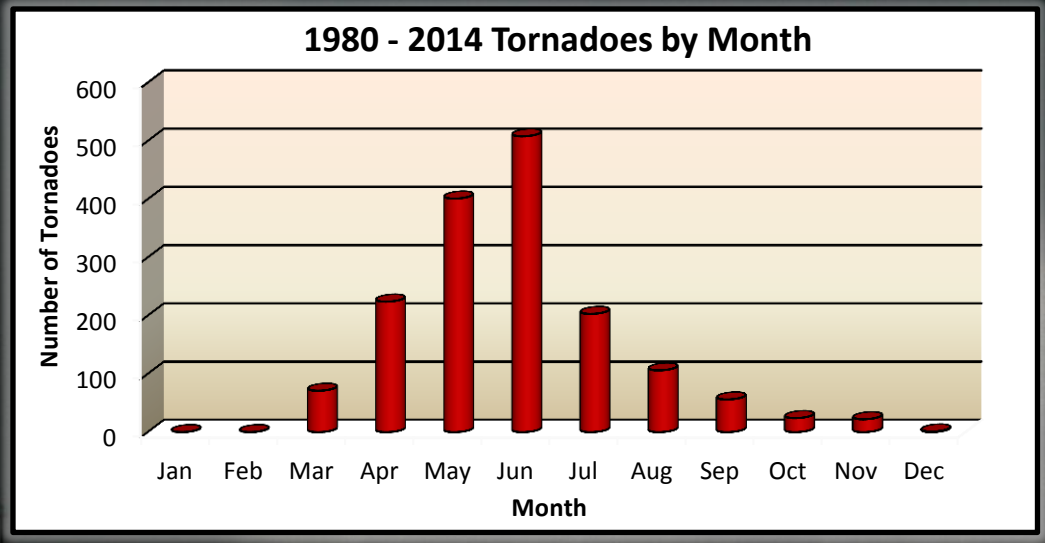
Northwestern Des Moines – June 26

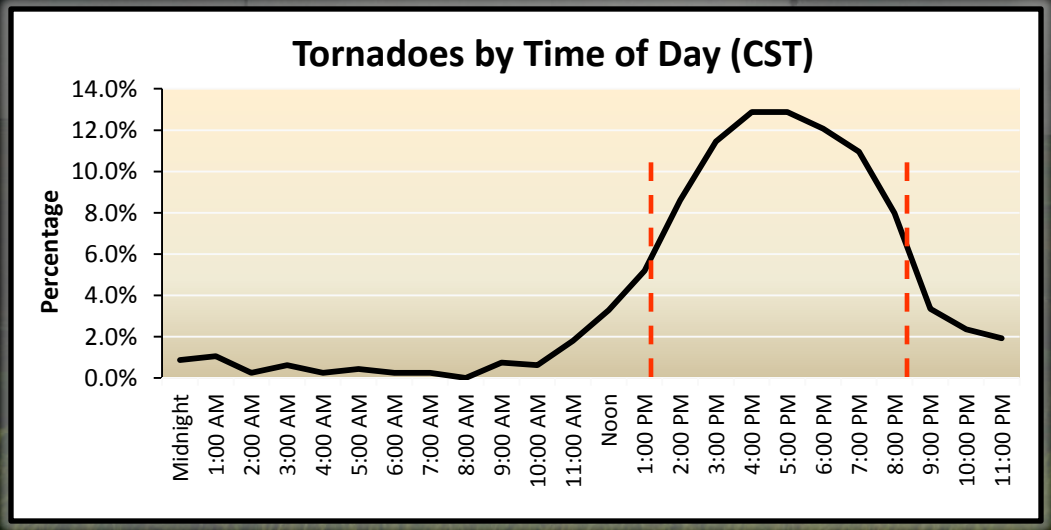
Near Cedar Rapids – June 30

Iowa Tornado Climatology

By Year:

- Average: 46
- Activity peaks in May and June
- Every month has seen a tornado





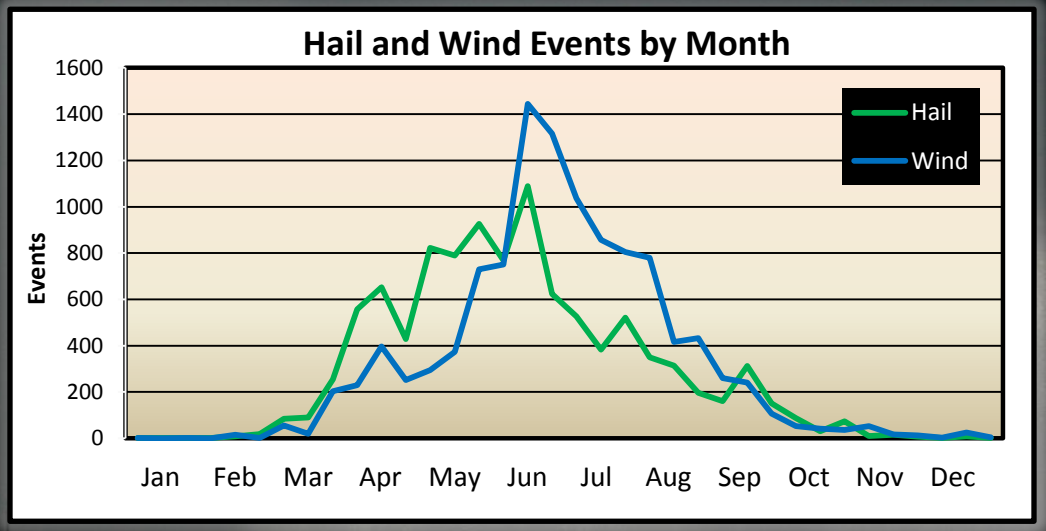
By Time:

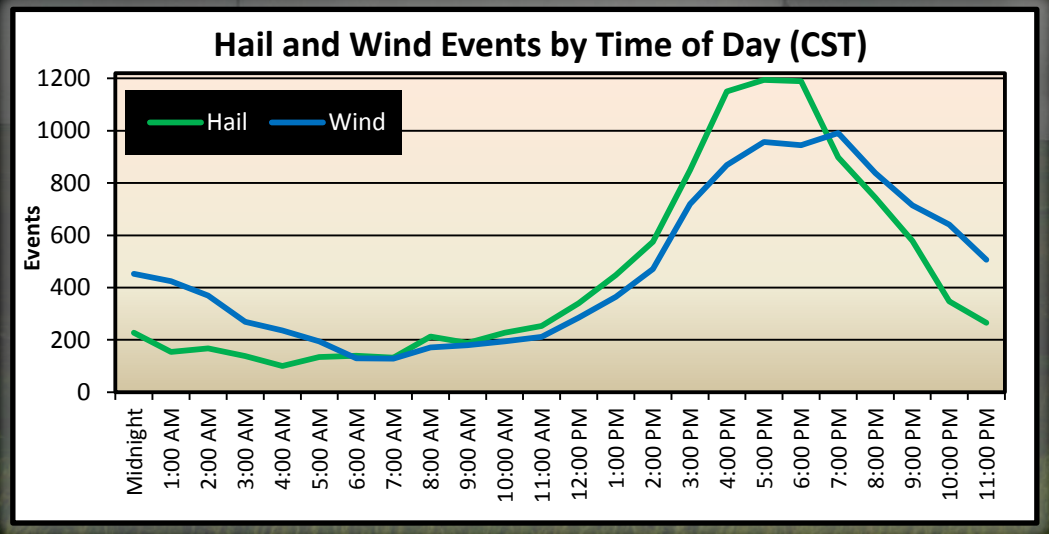
- Most tornadoes occur between 1 & 8 PM
- Minimum at night
- However, can occur at any time of day!

Iowa Hail & Wind Climatology

By Month:

- Peak Threat for Hail:
  Spring – Early Summer
- Peak Threat for Wind:
  Late Spring – Summer
- Occasional events into fall



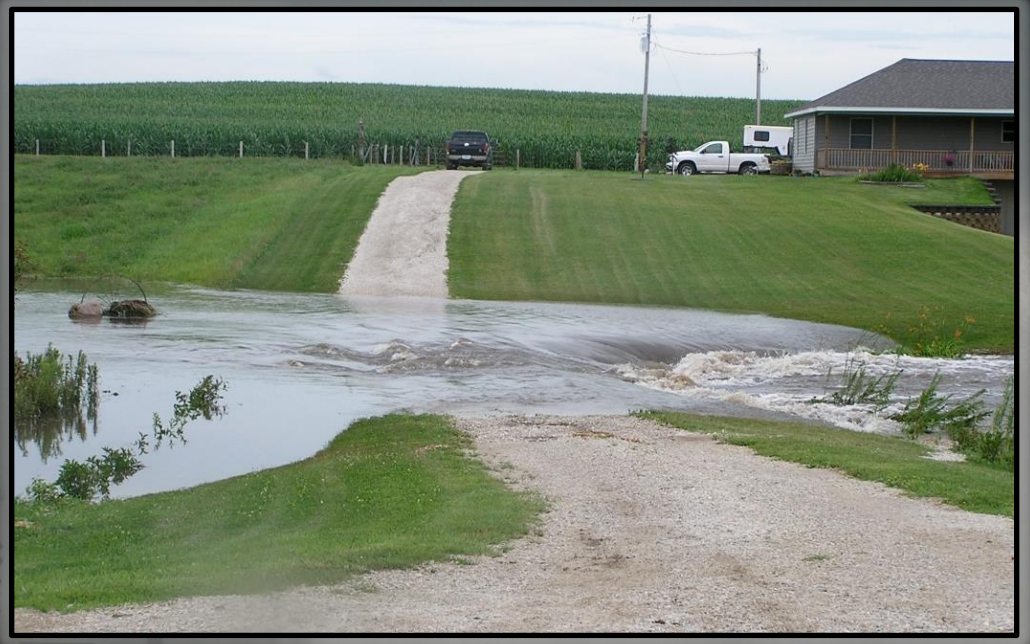


By Time:

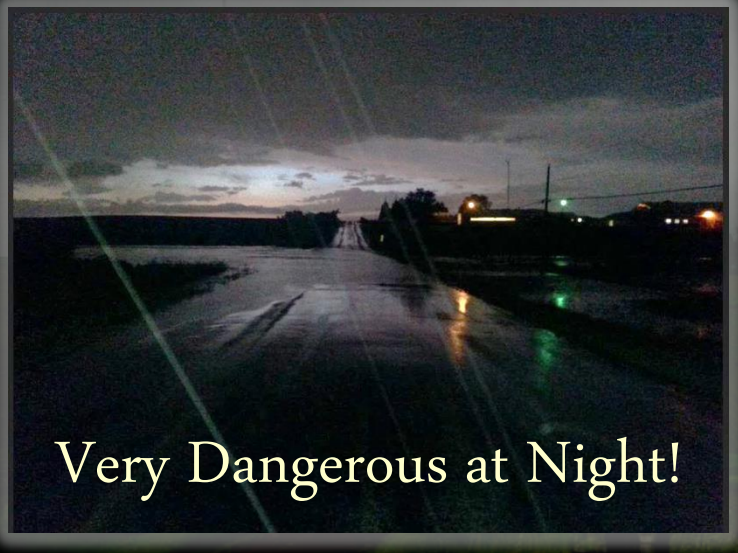
- Peak Time for Hail:
  Afternoon Hours
- Peak Time for Wind:
  Mid Afternoon – Early Morning

Iowa Flash Flood Climatology

- Usually caused by heavy rain (spring/summer)
- Can be caused by ice jams and dam failures



Courtesy Gaylin Crim



Courtesy Russ Wood (Twitter)

Most At Risk:

Low-lying regions/depressions

Areas with poor drainage (e.g. cities)

Locations around streams/rivers

Thunderstorm Fundamentals

Thunderstorm Ingredients

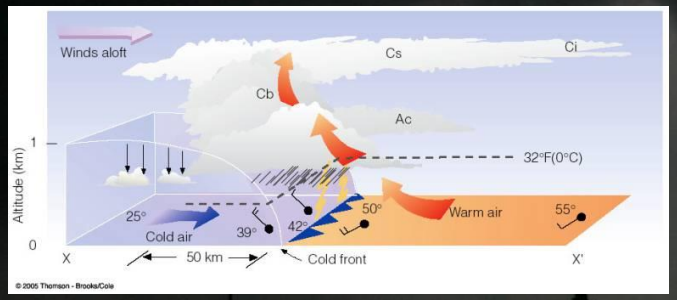
Thunderstorm Lifecycle

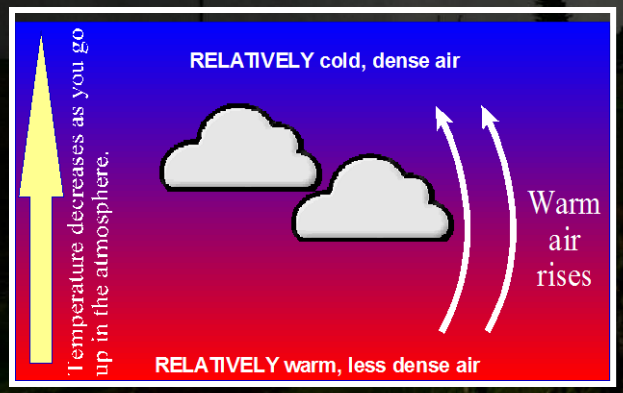
Storm Types

Features of Strong & Severe Storms

Courtesy Gem Rhoden

Thunderstorm Ingredients

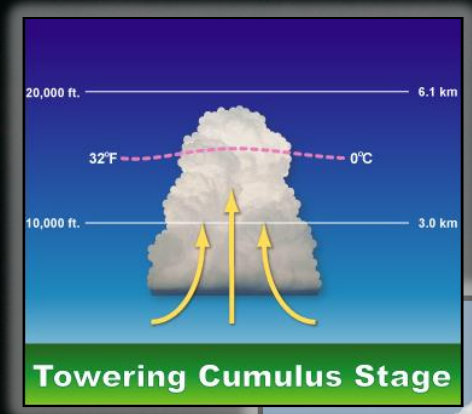


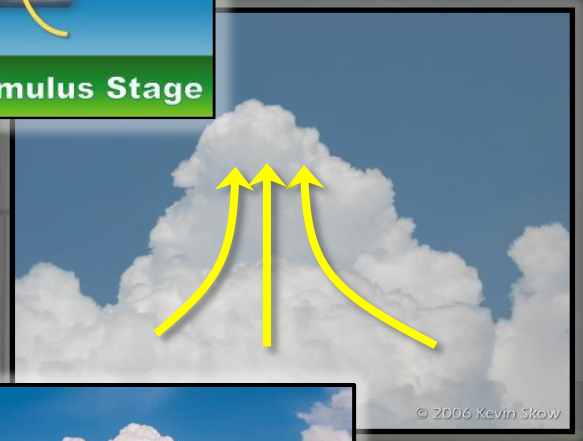


- **Moisture**
  - Forms clouds and precipitation
    - Common source: Gulf of Mexico
- **Lift**
  - Mechanism that forces air to rise
    - Common source: weather fronts
- **Instability**
  - Necessary for a storm's updrafts to grow
    - Example: Warmer (lighter) air under colder (heavier) air

Stage 1: Development Stage

Thunderstorm Lifecycle



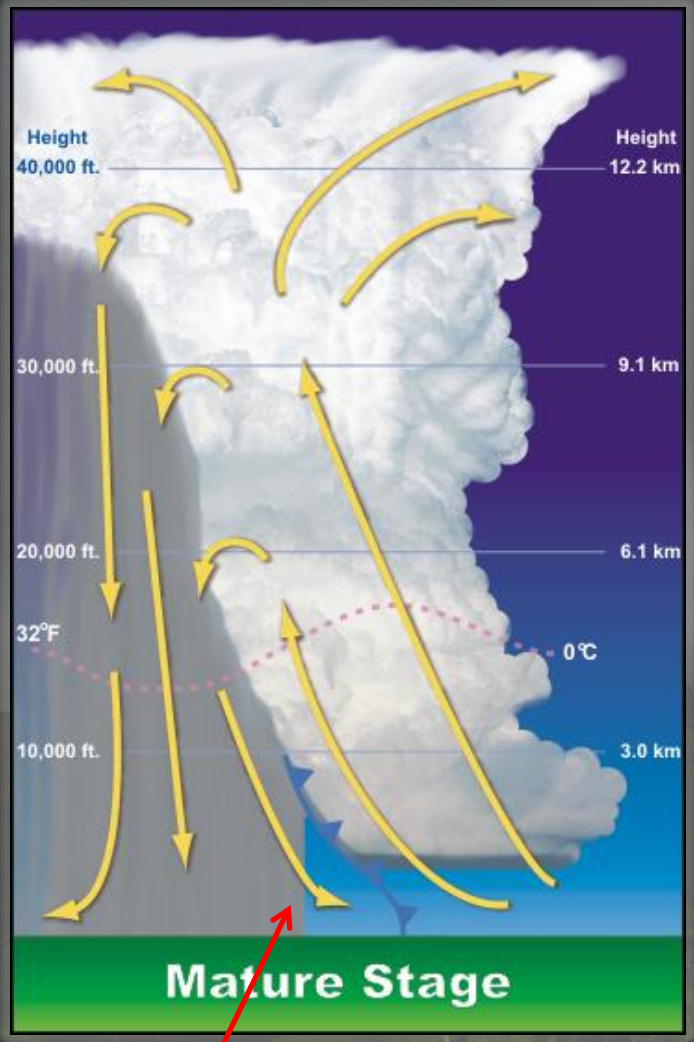


Images Courtesy
Kevin Skow

- Air rises, cools, and condenses into cumulus clouds
- The rising air is known as the storm's **updraft**
- Cloud droplets collide, grow larger, and descend towards the ground
- These falling drops form the storm's **downdraft**, and the storm enters Stage 2

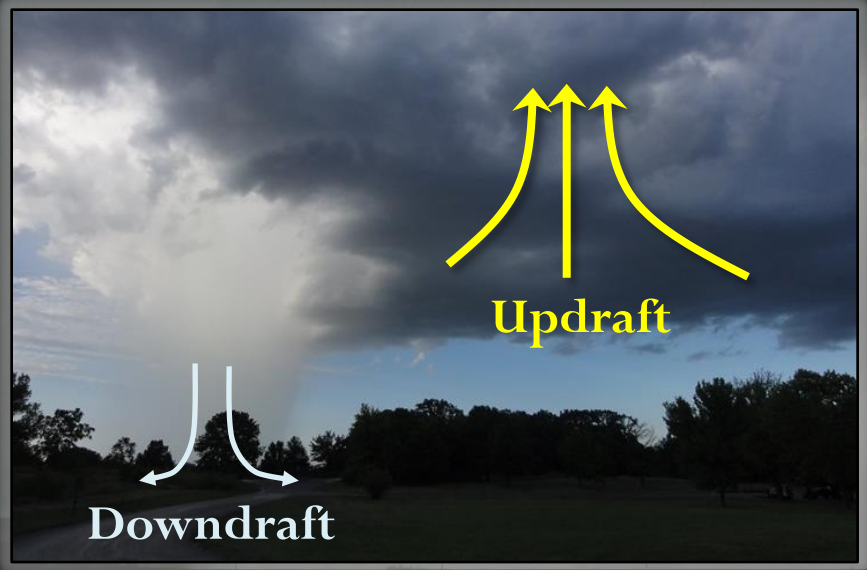
Stage 2: Mature Stage

Thunderstorm Lifecycle



Action Area

Updraft and downdraft coexist

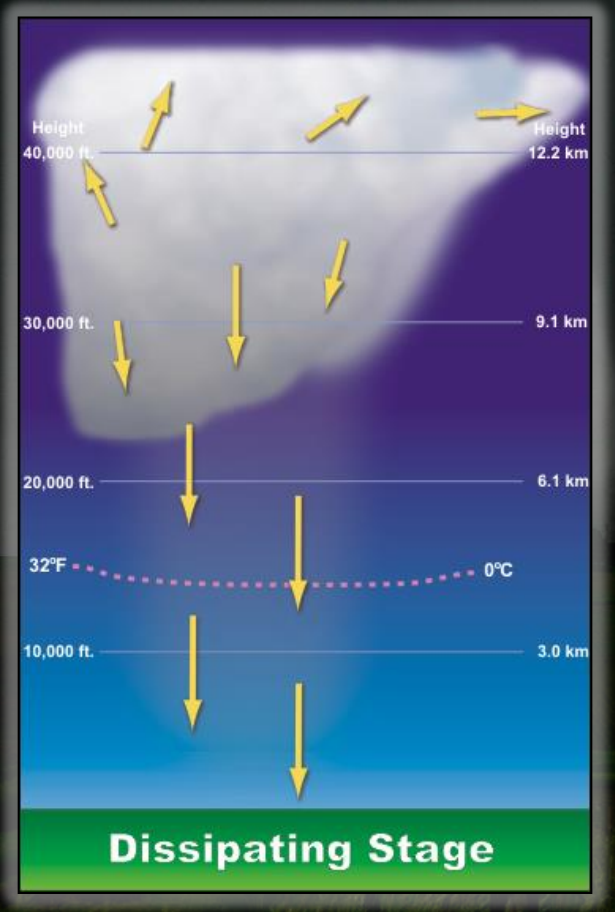


The most important stage since this is when the majority of severe weather occurs

Stage 3: Dissipating Stage

Thunderstorm Lifecycle

Downdraft cuts off the storm updraft, storm begins to dissipate



Courtesy Kevin Skow

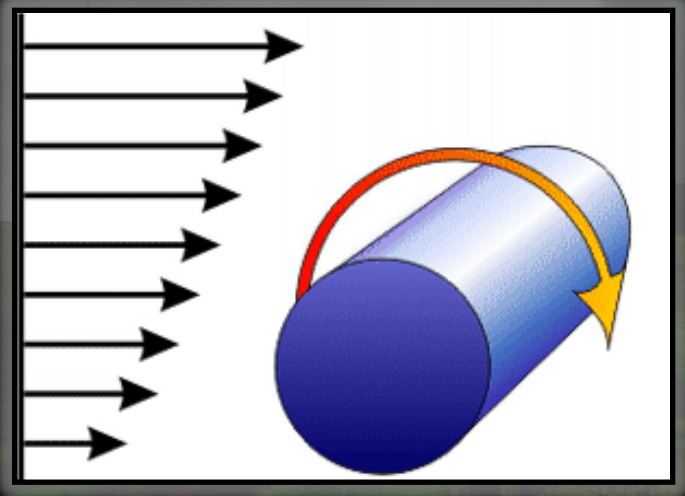
Severe weather threat decreases rapidly in this stage

Adding to the Mix – Wind Shear

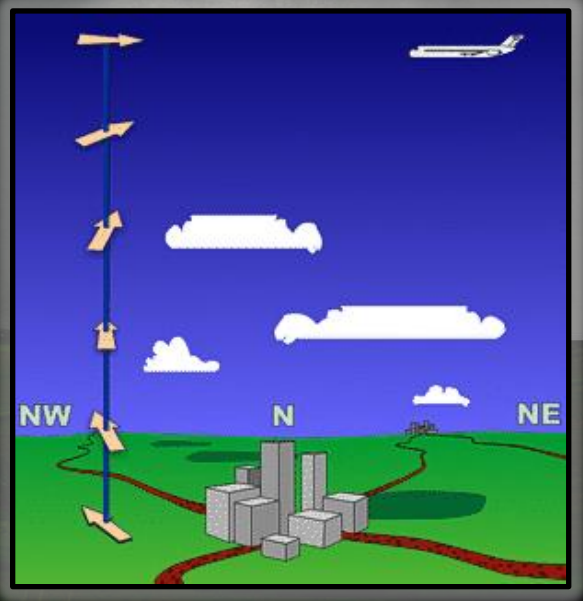
Thunderstorm Ingredients

What is Wind Shear?

- A change in wind speed or direction with height
- Two types of shear: speed and directional
- Can be deep or shallow



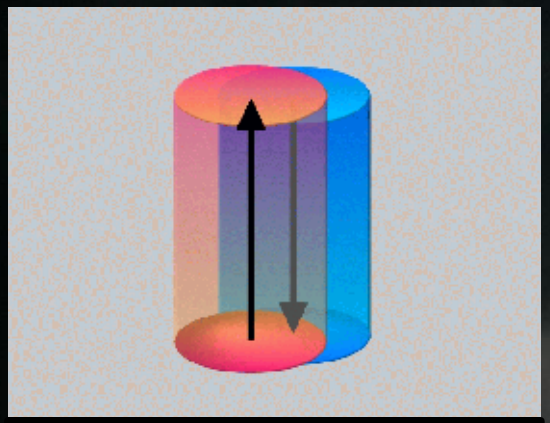
Speed Shear



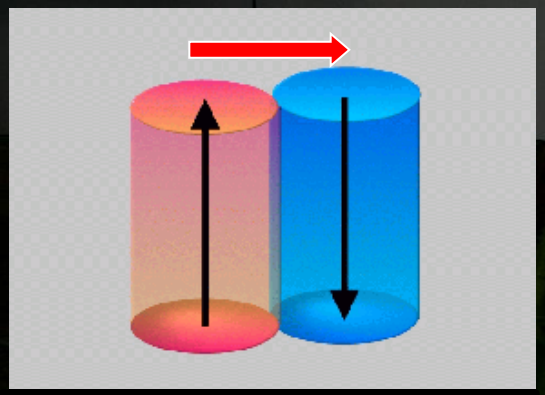
Directional Shear

Why is Wind Shear Important?

Thunderstorm Ingredients



Weak Shear

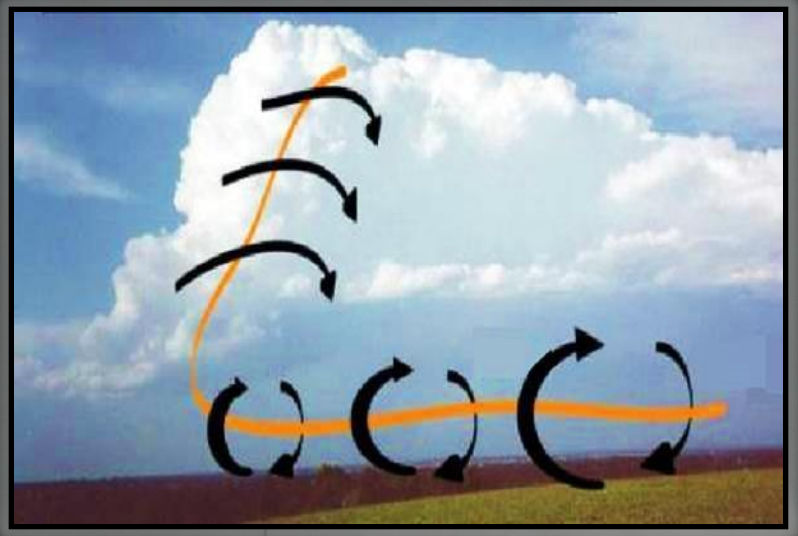


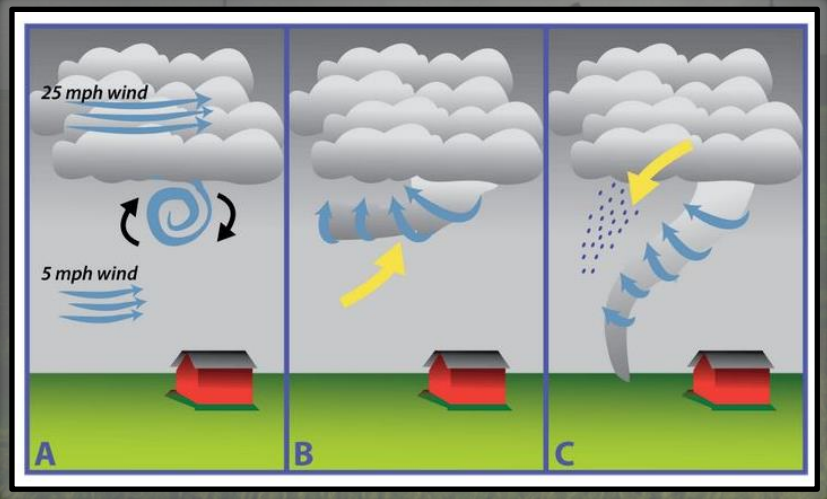
Strong Shear

- Tilts the storm's updraft
- Updraft and downdraft coexist without interfering with each other
- Storm remains in the mature stage for a longer period of time
  - Threat for severe weather increases
- Induces updraft rotation, further enhancing the severe weather threat

Low-Level Wind Shear

Thunderstorm Ingredients





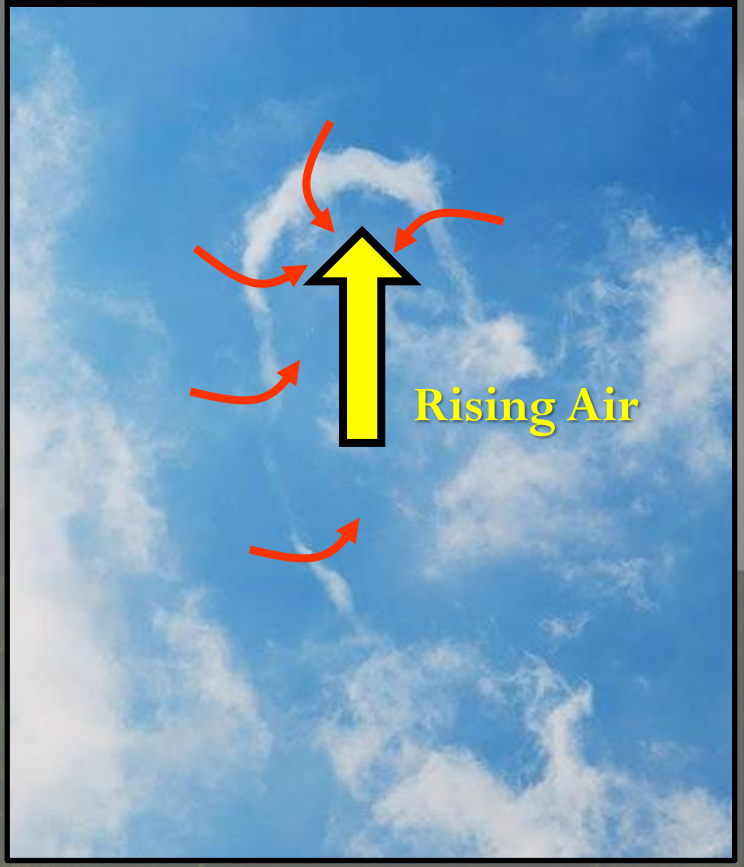
- Wind shear just above the surface (0-1 km)
- Lifted into the vertical by the storm's updraft
- Generates low-level rotation, increasing a storm's tornado potential

Wind Shear Examples

Thunderstorm Ingredients

Updraft being Tilted by Deep Speed Wind Shear

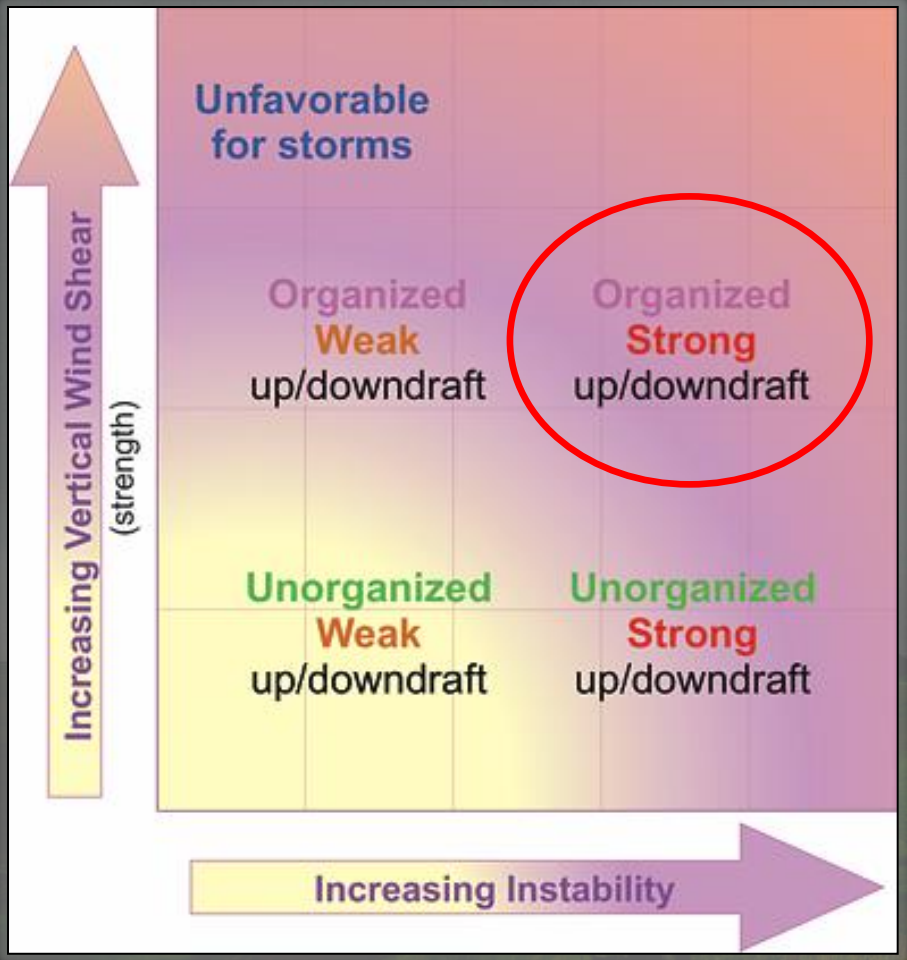
Low-Level Wind Shear being Lifted into the Vertical



Photos Courtesy Kevin Skow

Putting it all Together

Thunderstorm Ingredients



Greater Instability = Stronger Updrafts & Downdrafts

Stronger Wind Shear = More Organized and Longer-Lived Storms

A combination of high instability and strong wind shear often results in severe weather

Thunderstorm Types

Single Cell

Multi-Cell Line

Multi-Cell Cluster

Supercell

Thunderstorms are categorized by their physical characteristics

A combination of the different ingredients lead to the various storm types

Single Cell (Pulse) Storms

Thunderstorm Types

- Short-lived: 30-45 minutes
- Form in weak wind shear
- Typically non-severe

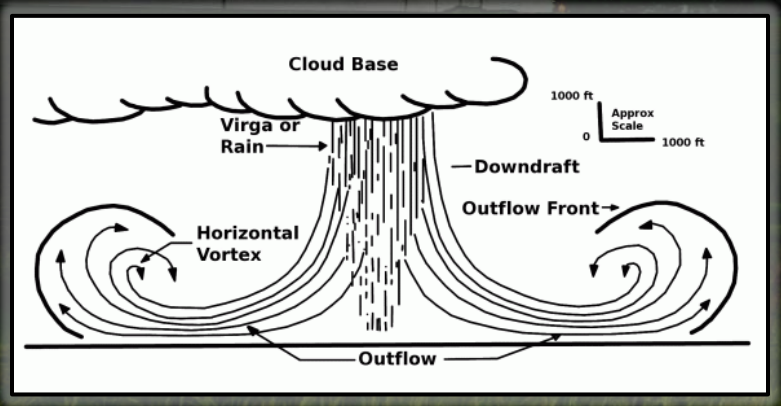
If severe, hazards include:

- ✓ Brief small/moderate hail
- ✓ Small-scale winds (microburst)
- ✓ Weak tornadoes (rare, most common early in the storm's life)

Microbursts

Single Cell Thunderstorm Hazards

- Downward rush of air that hits the ground and spreads outward
- Winds can exceed 80 mph
- Only a few square miles in size and last ≈ 5 minutes
- Difficult to detect on radar

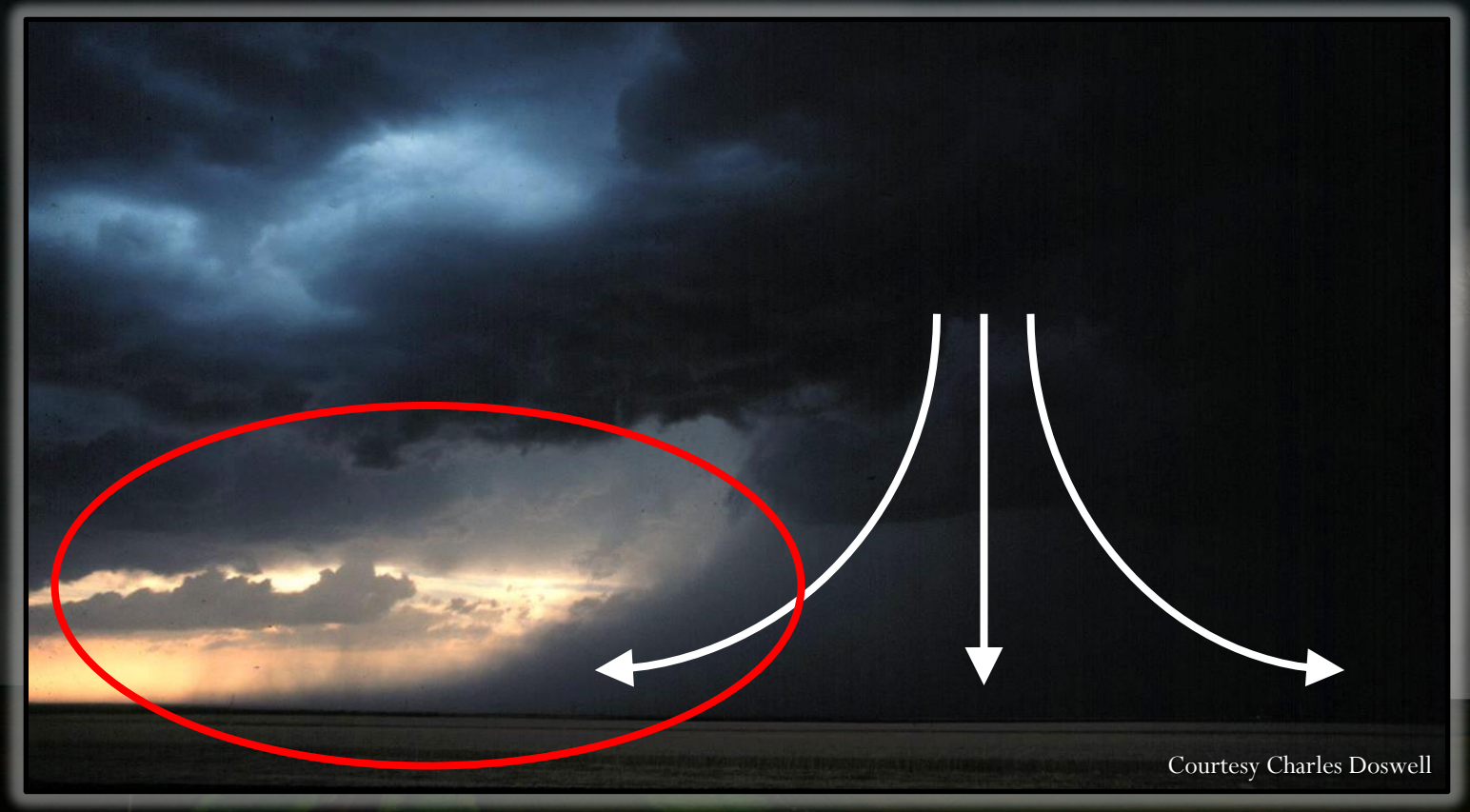


Lake Panorama – September 10, 2013

Courtesy Iowa Environmental Mesonet

Spotting Microbursts

Single Cell Thunderstorm Hazards

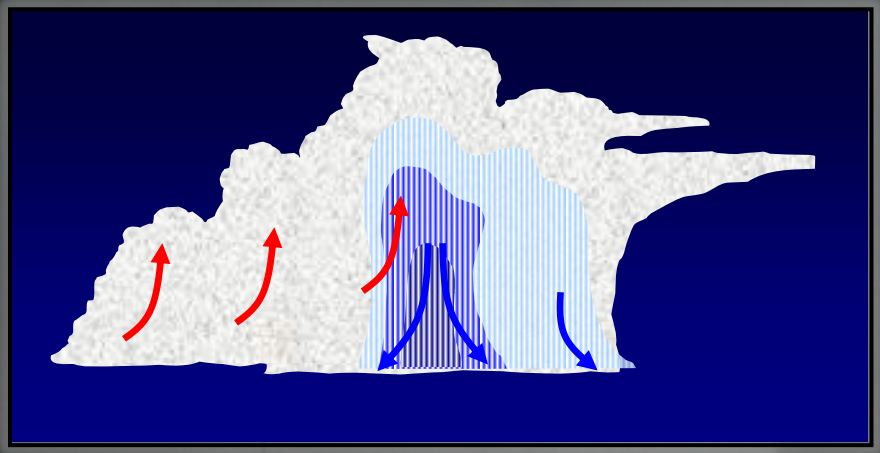


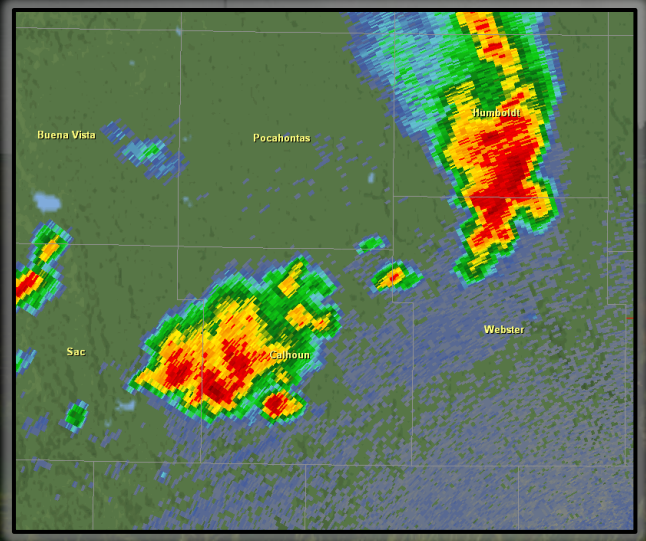
Rain Foot

A pronounced outward deflection of the precipitation near the ground

Multi-Cell Cluster Storms

Thunderstorm Types



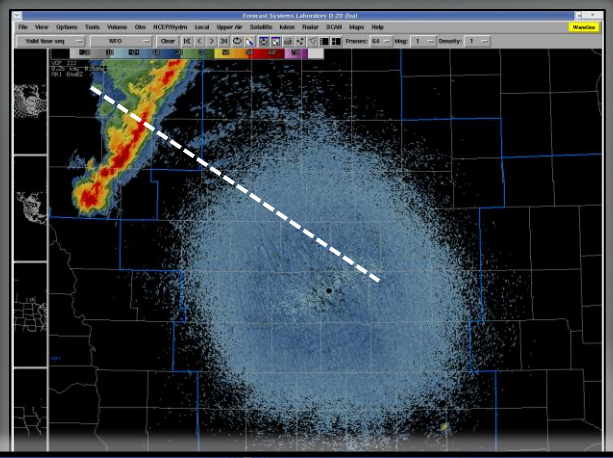


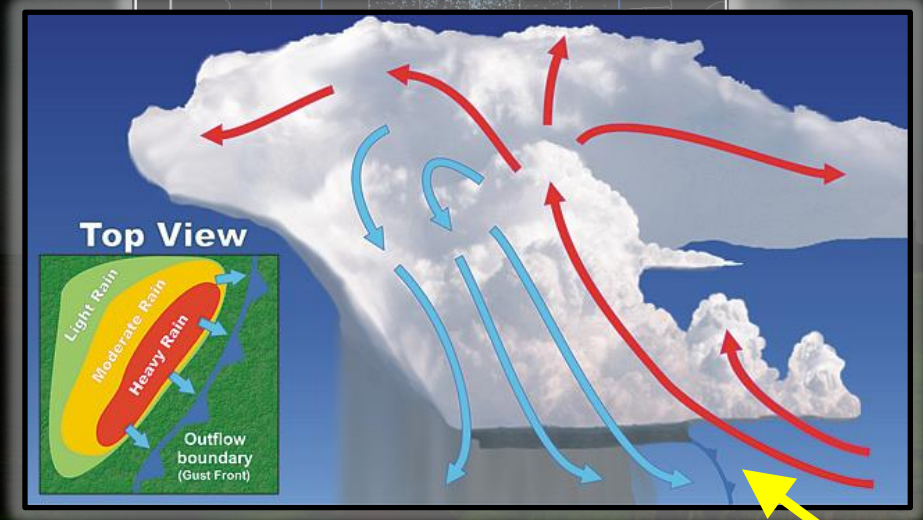
- Multiple updrafts in close proximity to one another
- Appears as a single unit
- Cells develop, mature, and dissipate as they move through the cluster
- Most common type of storm in Iowa

Can be a major flash flood threat!

Multi-Cell Line Storms

Thunderstorm Types





Squall Line Cross Section

Gust Front

- Also known as a **squall line**
- A "line" of storms where the individual downdrafts merge together
- The leading edge of this continuous downdraft is called the **gust front**
- The gust front produces a signature cloud known as a **shelf cloud**

Shelf Clouds

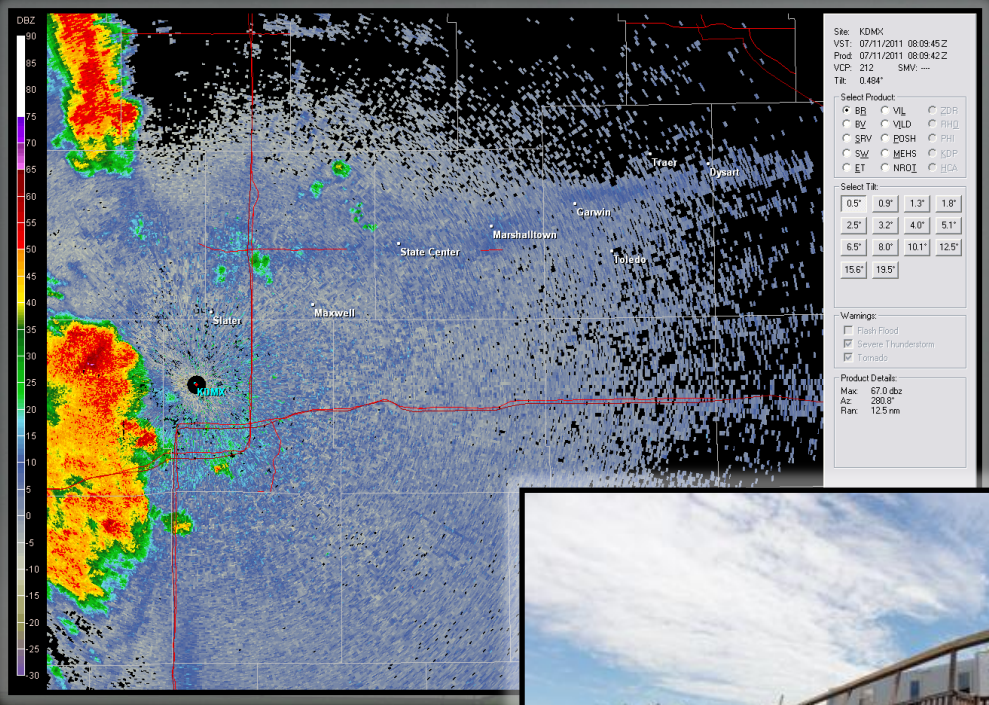
Multi-Cell Line Storms

Courtesy Ken Podrazik

- Often associated with squall lines, but can occur with individual storms
- Located on the leading edge of the line, or near gust front
- Long, flat cloud which slopes down from the rain

No Vertical Rotation

Squall Line Hazards



East Iowa Derecho
July 11, 2011

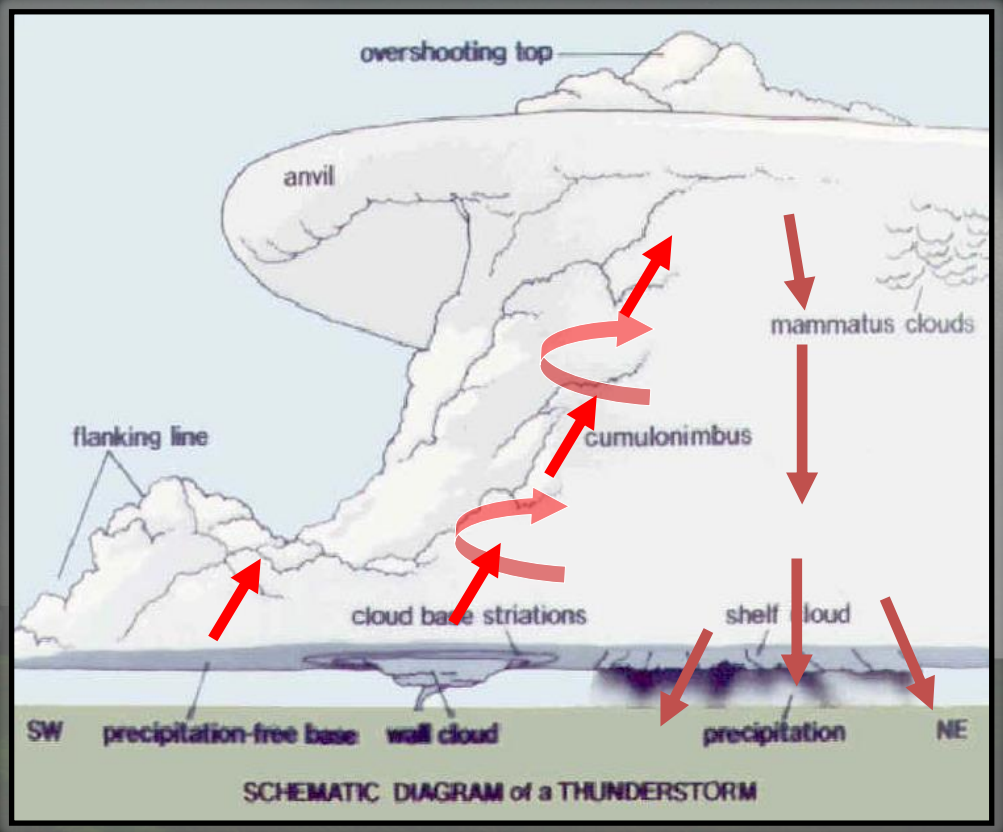
Widespread Damaging Winds

- Moderate sized hail
- Heavy rain
- Occasional tornadoes

Supercell Storms

Thunderstorm Types

- Highly organized
- Updrafts can exceed speeds of 100mph!
- Can produce extremely large hail and violent tornadoes
- Pose a high threat to life and property!



Supercell Thunderstorm Diagram

Classic Supercells

Supercell Types

- Large, flat updraft base
- Persistent, rotating updraft
- Rotating wall cloud often present
- Heavy rain in the forward region of the storm
- Large hail likely near updraft/downdraft interface

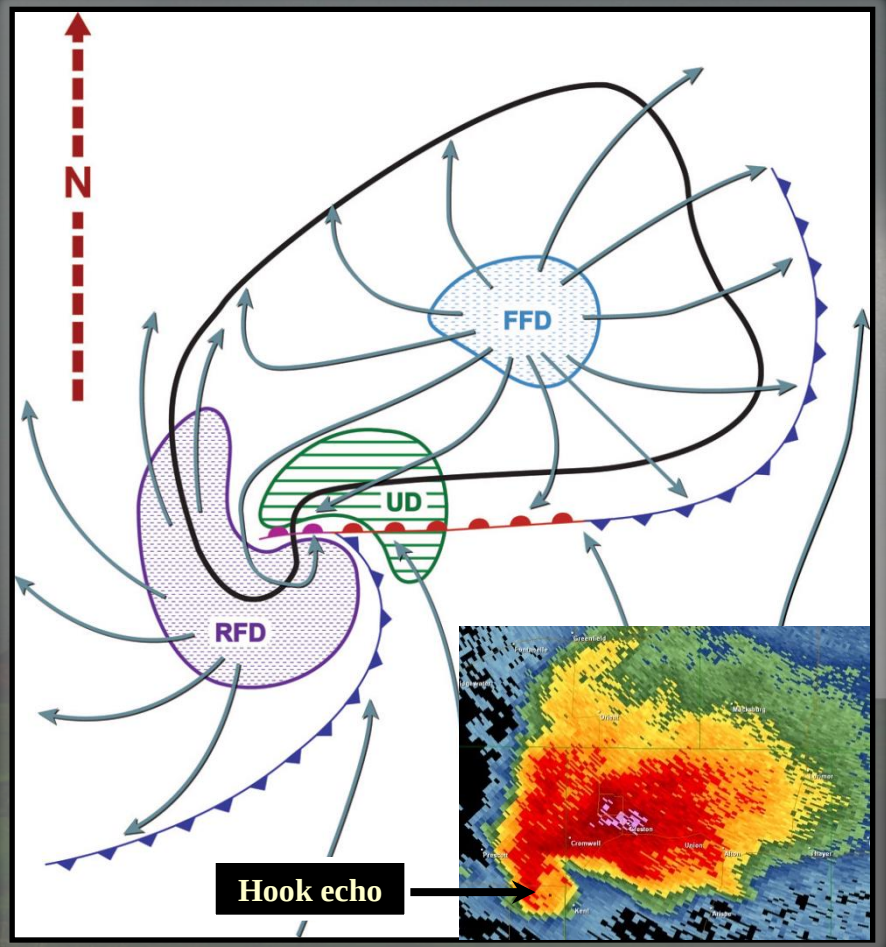
Artist Rendition of Classic Supercell

Classic Supercells

Supercell Types

Updrafts and Downdrafts

- **Forward Flank Downdraft (FFD):** Large downdraft with torrential rain and hail
- **Updraft (UD):** Large hail is often near the interface of the UD and FFD
- **Rear Flank Downdraft (RFD):** Region of dry air wrapping into the back of the UD



High Precipitation Supercells

Supercell Types

- Also called "HP" or "front-flank" supercells
- Updraft on the front of the storm
- Heavy rain often obscures wall clouds and tornadoes
- Common in Iowa!

Artist Rendition of an HP Supercell

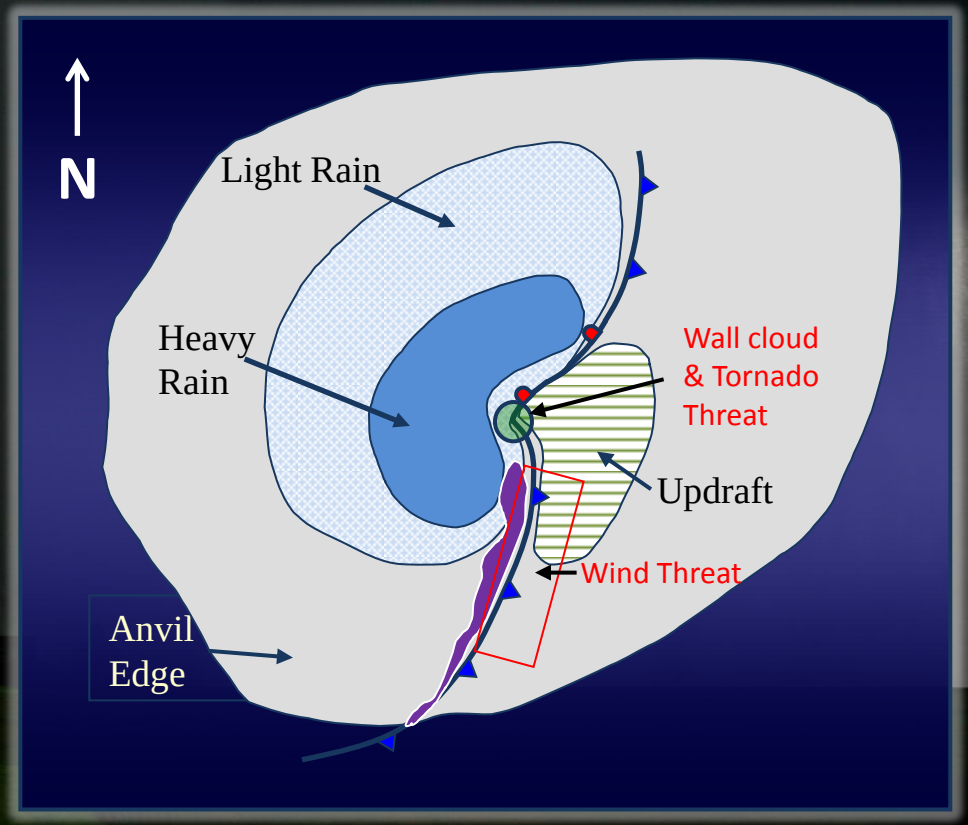
High Precipitation Supercells

Supercell Types

What makes this different from a classic supercell?

- RFD filled with rain
- May have a shelf cloud along the RFD gust front
- Extremely heavy rain may cause flash flooding

HP Supercells can often transition to squall lines



High Precipitation Supercell Diagram

High Precipitation Supercells

Supercell Types

Courtesy of Tim Jones

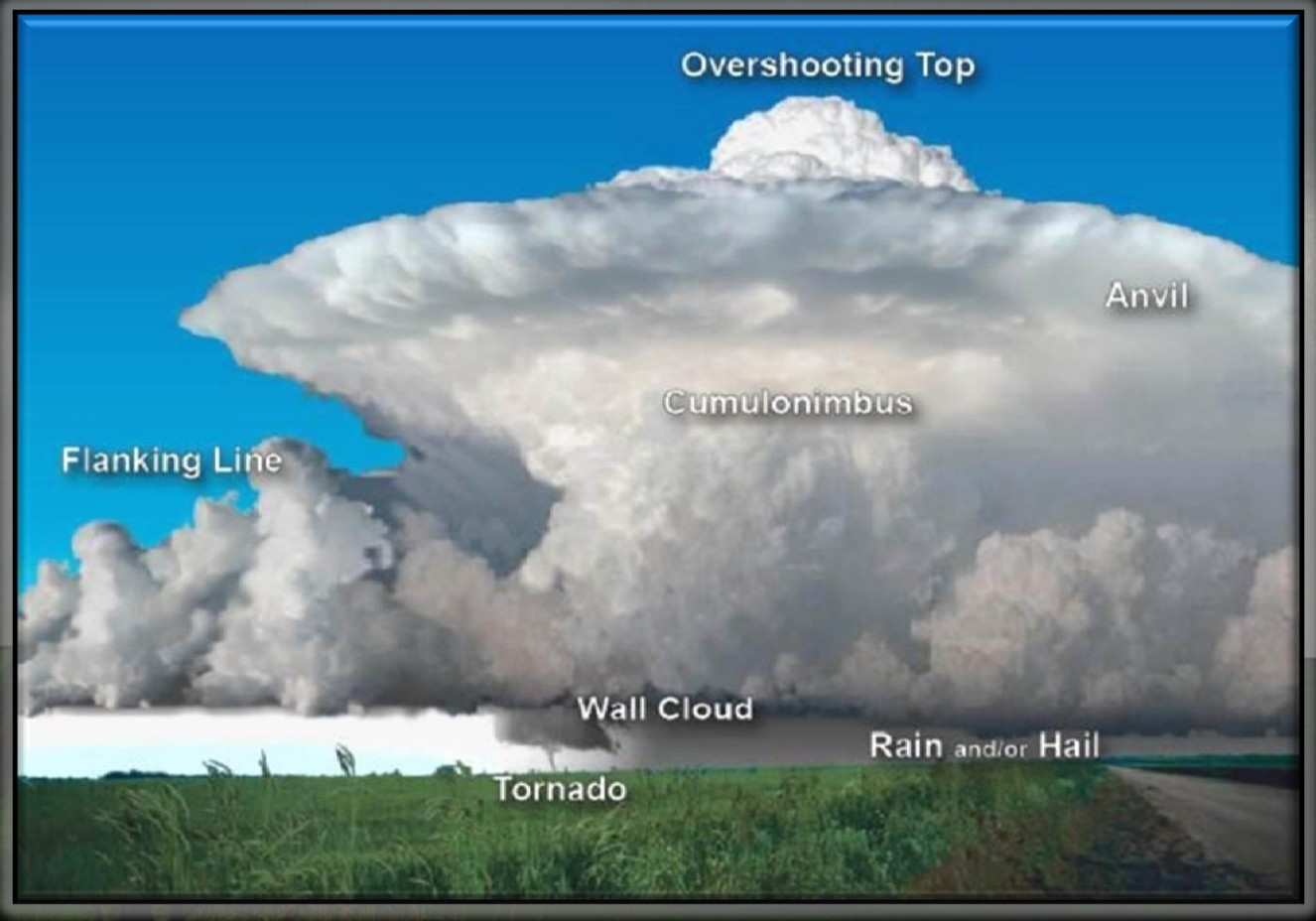
Courtesy of Al Moller

Note the Shelf Cloud along the RFD Gust Front

High Precipitation Supercell Examples

Features of Strong & Severe Storms

From the Top of the Storm



To the Storm Base

Anvil

Features of Strong & Severe Storms

- Elongated cloud at the top of the storm that spreads down-wind
  - Common with many storms
- **Strong Updraft Clue:**

  Solid (not wispy) anvil with a sharp, well-defined edge

Overshooting Top

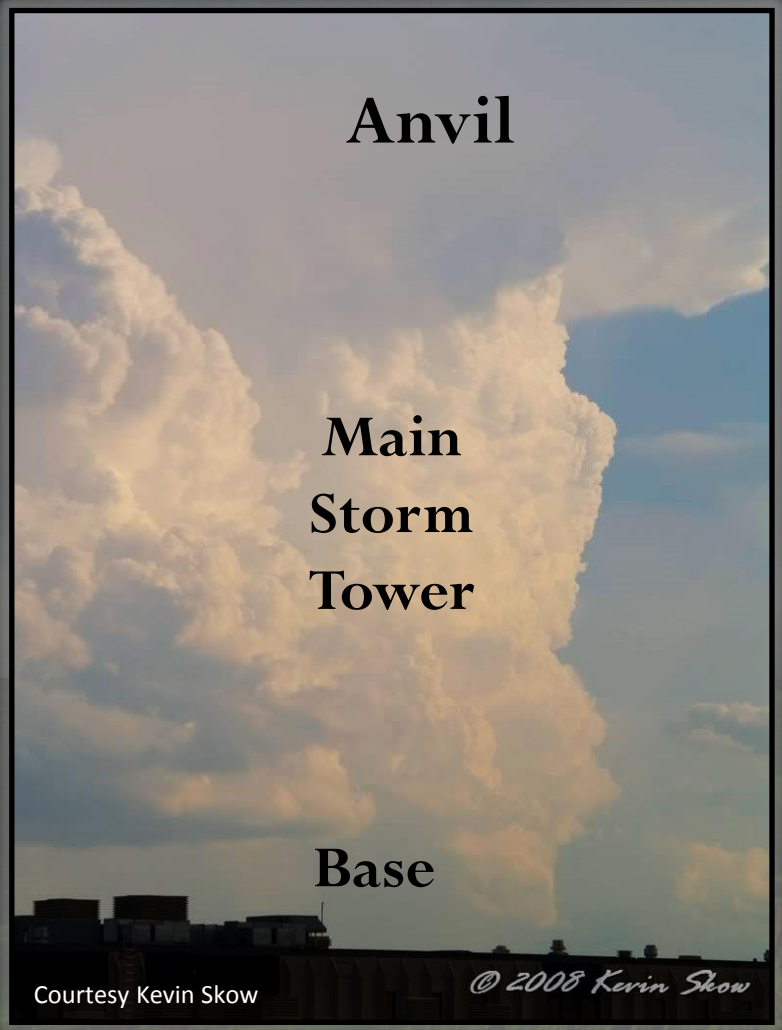
Features of Strong & Severe Storms

Dome above the main updraft tower and anvil

Strong Updraft Clue: Persists for more than 10 minutes

Main Storm Tower

Features of Strong & Severe Storms



Also known as the "trunk" of the storm or the visible updraft below the anvil

Strong Updraft Clue:

- Vertically oriented tower with sharp edges
- Solid, cauliflower appearance

Wall Clouds

Features of Strong & Severe Storms

Courtesy of Kevin Skow

Isolated cloud attached to the bottom of the updraft

Can be associated with both severe and non-severe storms

Wall Clouds

Features of Strong & Severe Storms

Courtesy of WOI-TV

Signs of a Severe Wall Cloud

- Visible rotation and rising motion into the cloud
- Lasts for at least 10 minutes
- Strong winds rushing towards the wall cloud

Funnel Clouds

Features of Strong & Severe Storms

- Narrow, tube-like cloud extending down from the base of a storm or wall cloud
- **Will be rotating**
  - Often smooth in appearance
- If the funnel circulation comes in contact with the ground, it becomes a tornado
  - Look below the funnel for swirling dust or debris as a tipoff that it has become a tornado

Tornadoes

Lifecycle

Locations in Storms

Variations

Falsenadoes

Courtesy KCCI

Stage 1: Development Stage

Tornado Lifecycle

Connection of dust whirl to a rotating wall cloud, a funnel cloud, or cloud base

Stage 2: Mature Stage

Tornado Lifecycle

Widening funnel, vertically orientated

Funnel often extends completely to the ground

Tornado is likely at its strongest in this stage!

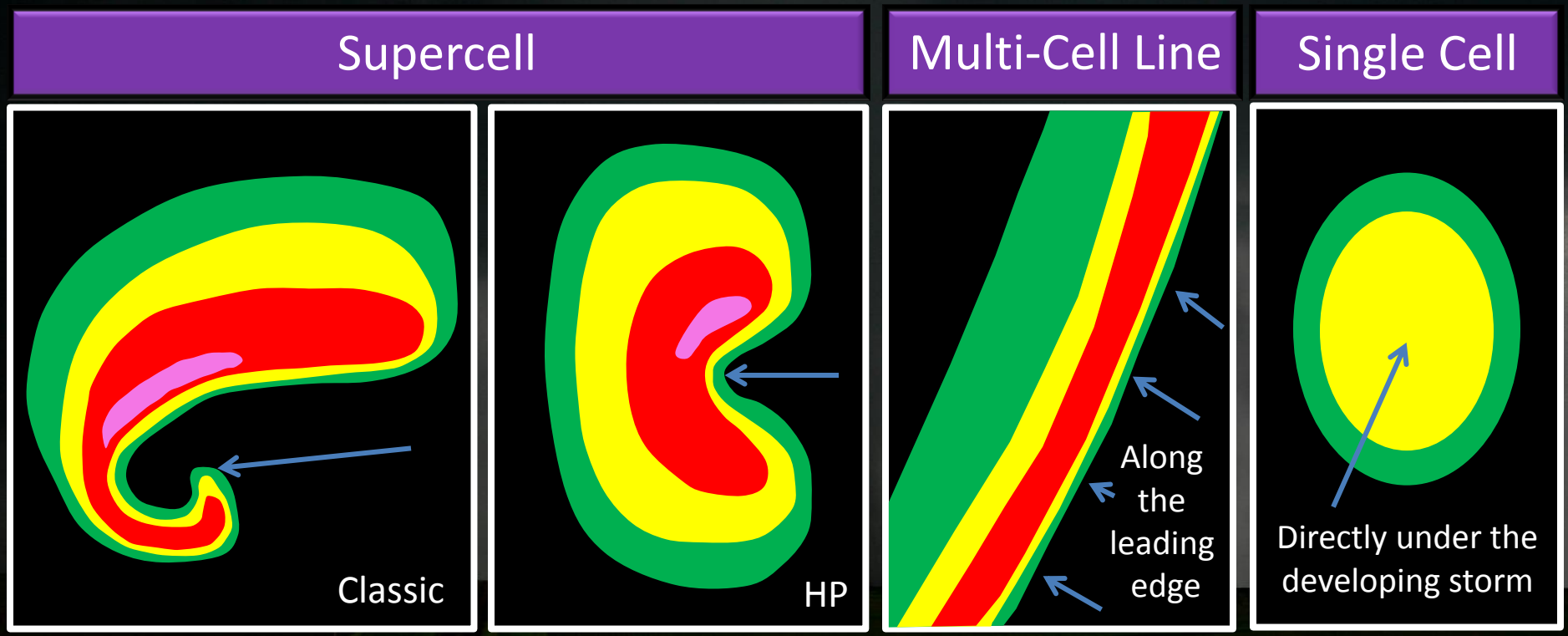
Stage 3: Dissipating Stage

Tornado Lifecycle

The funnel becomes a thin rope and then dissipates.

The tornado may still be very dangerous at this stage!

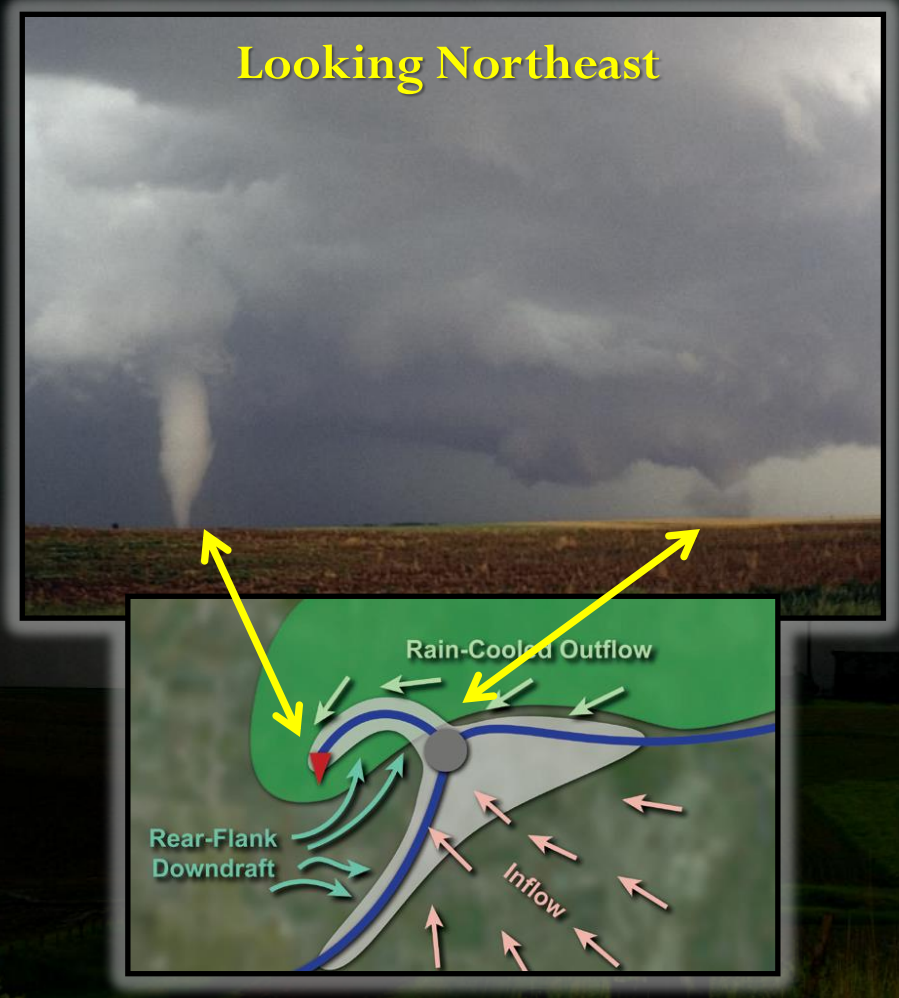
Tornado Locations in Storms



Bottom Line: Tornadoes can form in various locations, depending on the storm type

Supercell Tornadoes

Tornado Locations in Storms



"Cyclic" Supercells

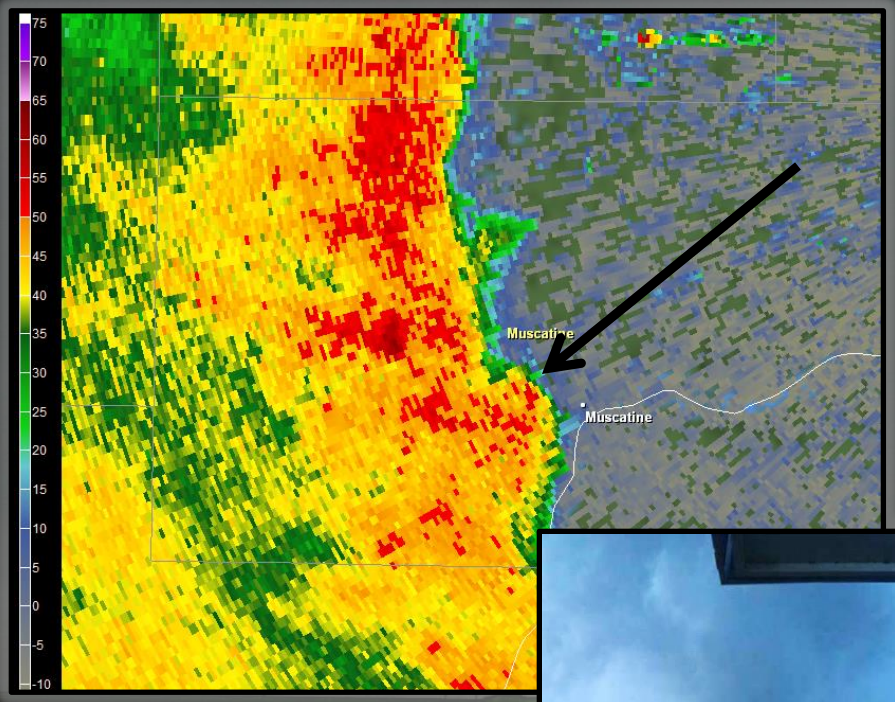
- Special form of supercell that can produce more than one tornado at a time
- As old tornado weakens and dies, a new tornado forms out ahead of it

Hampton, IA
June 12, 2013

Courtesy KCCI uLocal

Multi-Cell Line Tornadoes

Tornado Locations in Storms



Muscatine, IA
June 24, 2013

- Tornadoes can form at the leading edge of squall lines (along the gust front)
- Often short-lived, but can still be damaging
- Tornadoes are rain-wrapped in many cases
- Can form very quickly and be difficult to detect on radar!

Single Cell Tornadoes

Tornado Locations in Storms

- Tornadoes with these storms are known as **landspouts**
- Form in the developmental phase of thunderstorms

Characteristics

- Little precipitation, no wall cloud, usually a thin funnel
- "Waterspouts over land"

Often impossible to detect on radar!

Tornado Variations

Courtesy Rod Donavon

Wedge Tornado

New Hartford, IA 2008

Courtesy KCCI uLocal

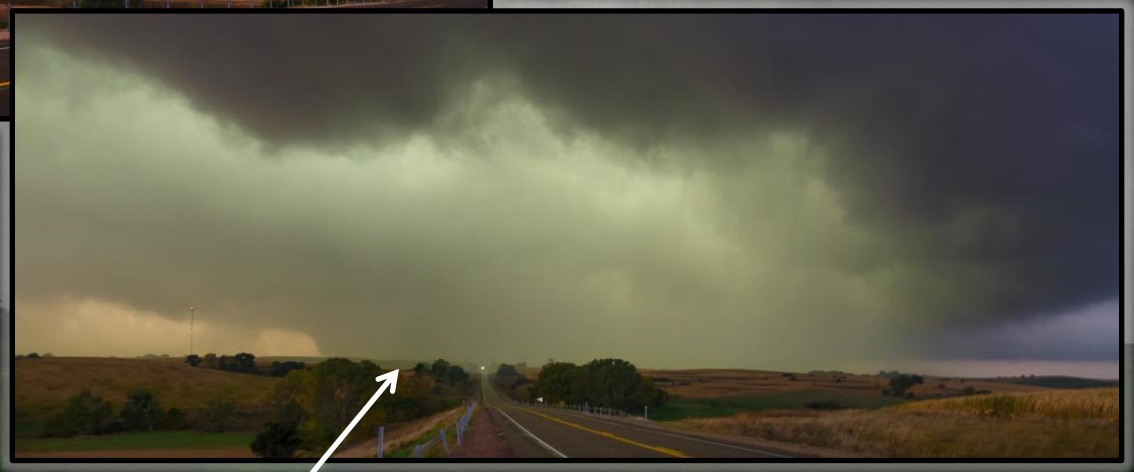
Cone-Shaped Tornado

Reinbeck, IA 2014

Wedge tornadoes tend to be intense. However, the strength of a tornado cannot be determined by observation!

Rain-Wrapped Tornadoes

Tornado Variations



Photos Courtesy Kevin Skow

Moville, IA
October 4, 2013

Rain-wrapped tornadoes are often associated with HP supercells and squall lines

Invisible Tornadoes

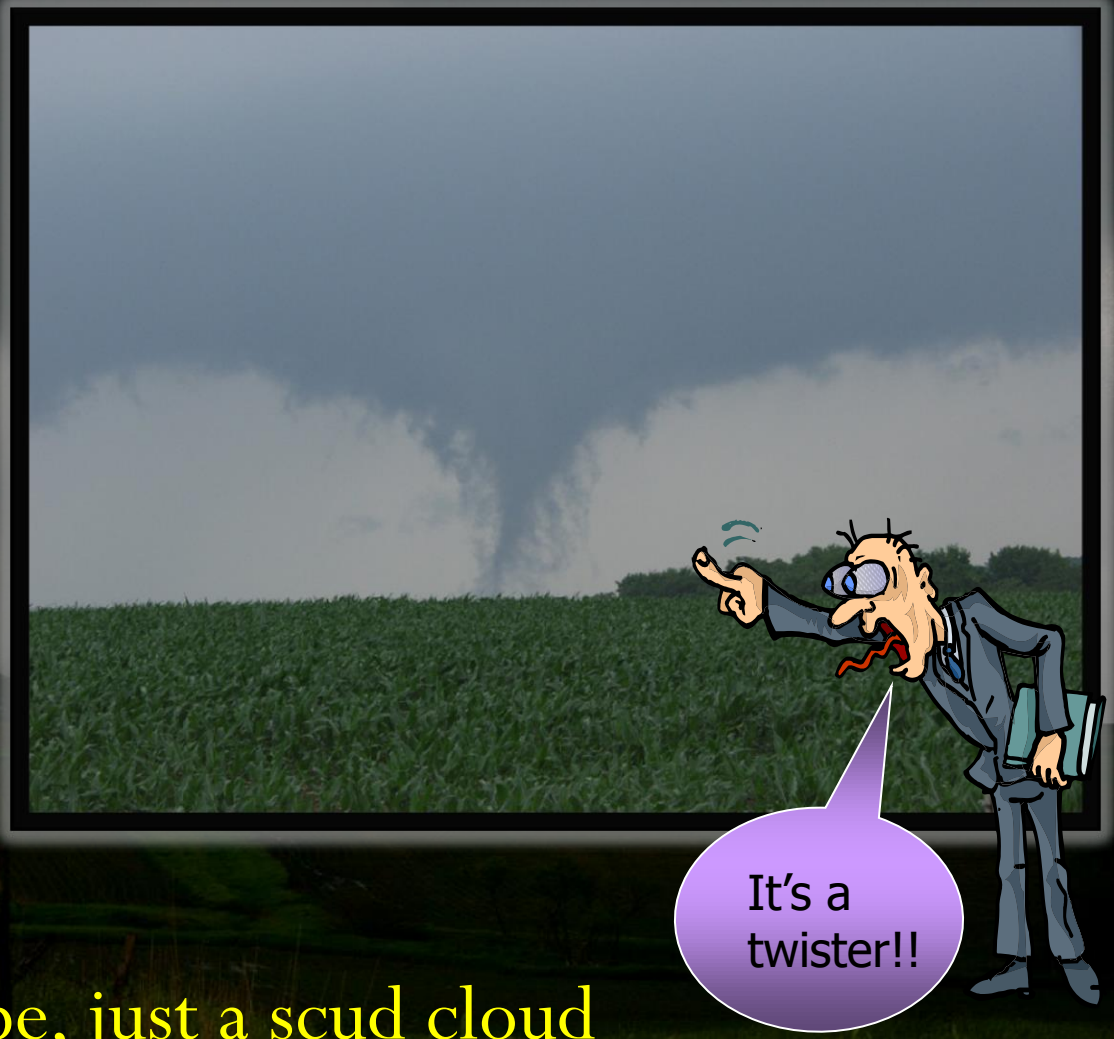
Tornado Variations

Courtesy Extreme Instability

Tornadoes do not always have a visible funnel!

Falsenadoes

- Gustnadoes
- Scud Clouds
- Shelf Clouds
- Dust Devils
- Rain Shafts
- Smoke Plumes
- Towers
- Grain Elevators



Nope, just a scud cloud

Gustnadoes

Falsenadoes

- Swirl of dust at the ground along the edge of a gust front
- Caused by winds surging out from a storm and is **NOT** connected to the cloud base, unlike a tornado
- Winds in a gustnado can still be strong and damaging

Gustnado or Tornado?

Falsenadoes

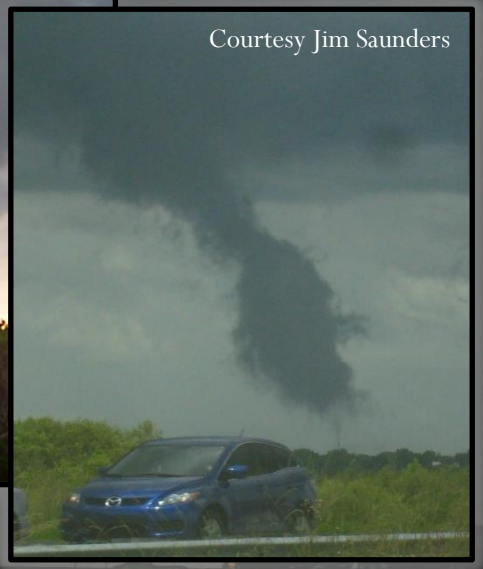
The answer is not always clear cut!

Both tornadoes and gustnadoes can form at the leading edge of a storm

To tell the difference, **look at the clouds above the dust swirl**. If they are rotating as well, then you likely have a tornado.

Scud Clouds

Falsenadoes

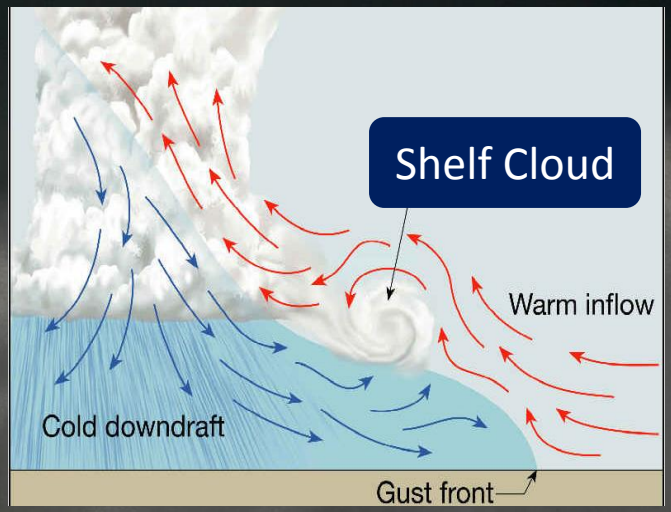


- Ragged clouds on the underside of a storm that are **NOT** attached to the main storm base
- Can resemble wall clouds, funnel clouds, and tornadoes
- Often short-lived and **do not** exhibit vertical rotation

Shelf Clouds

Falsenadoes

Photos Courtesy Kevin Skow



- Long, flat cloud along the front of a storm (resembles a shelf)
- When viewed from up-close or at night, can be mistaken for a funnel cloud
- Rotates in the horizontal, but not the vertical!

Dust Devils

Falsenadoes

Courtesy Bryant Eakins

Courtesy Joshua Jergens

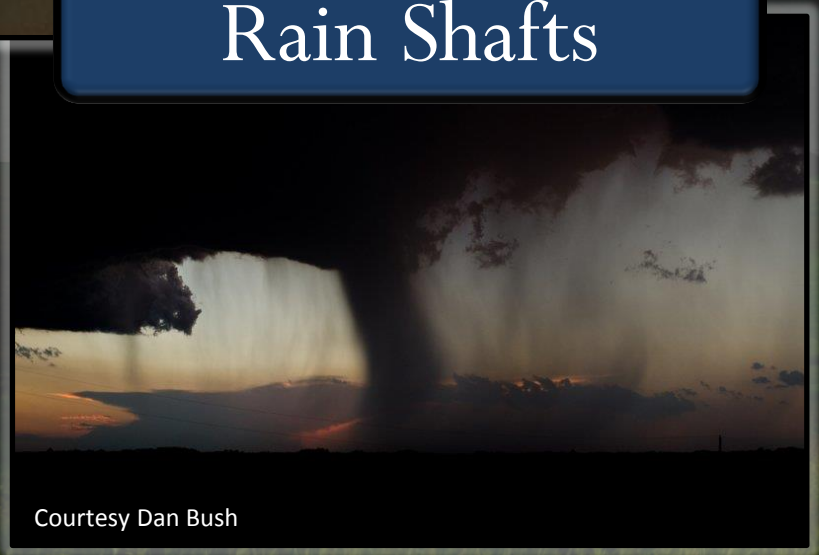
- Form on hot, sunny, summer days with light winds
- Can extend several hundred feet into the sky
- Winds are usually light and don't cause any damage

Rain Shafts & Smoke Plumes

Falsenadoes

Courtesy Andrew Revering

Rain Shafts



Courtesy Dan Bush

Smoke Plumes

http://australiasevereweather.com

Tornado Spotting Tips

Falsenadoes

If you are unsure:

Watch the feature for a few minutes and ask, "Is it…

- Rotating about a vertical axis?
- Attached to the cloud base?
- In the right location in the storm?
- Lofting debris or dust?

If you answer "no" to any of these questions, then it is probably NOT a tornado!

Conclusion

What this Training Provided:

- Knowledge about how to spot severe weather and communicate what is seen to the NWS
- Awareness about the inherent dangers associated with severe weather spotting
- An understanding that the NWS does not officially deploy spotters and that spotters deploy at their own risk!

Conclusion

What this Training ***Did Not*** Provide:

- Any official certification – being a spotter is voluntary
- A license to break any law, **including traffic laws**!
- Any official affiliation as a National Weather Service agent or employee

The End!

Thank you for Attending
Have a SAFE year!